Engineering Library
JAN 18 1932

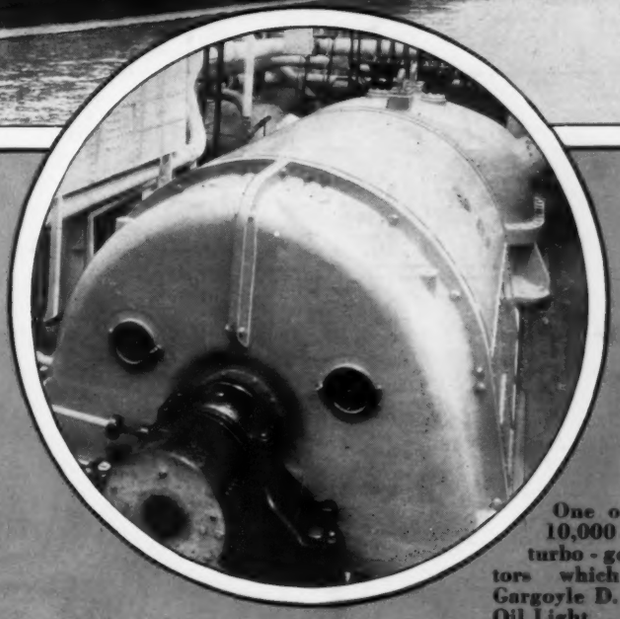
ELECTRICAL WORLD

JANUARY 16, 1932
McGraw-Hill Publishing Company, Inc.
25 cents per copy

S. S. JACONA—world's first sea-going power house

World's first sea-going power plant *uses* Gargoyle Lubricants

The New England Public Service Company of Augusta, Maine, recently put into service the first sea-going electrical power house, for emergency use in any port. The S. S. Jacona, a cargo steamer of 5,128 gross tons was rebuilt to house two 10,000-k.w. turbo-generators and four marine type super-heat boilers. Original power equipment was removed, which makes towing necessary when the ship is moved. A movable deck tower carries the heavily armored cable which makes shore connections untroubled by tidal rise and fall.



One of two 10,000-k.w. turbo-generators which use Gargoyle D. T. E. Oil Light

Gargoyle Lubricants were chosen exclusively to lubricate this most modern floating power station—another evidence of Vacuum Oil Company leadership in electrical power lubrication.

GARGOYLE
Lubricating Oils

VACUUM OIL COMPANY, Inc.

61 Broadway, New York City. Branches and warehouses throughout the world.

AGAIN WE SAY—

"what's worth sealing is worth sealing well"

with MURRAY PADLOCK SEALS

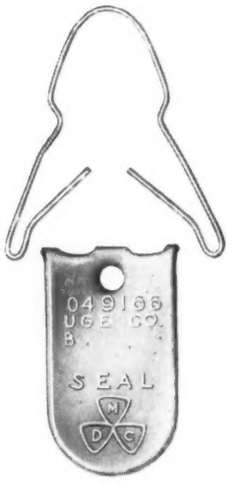
"1500 cases of theft out of a total of 9000 customers—in one town."

"Found as many as 56 suspects in one day."

"One of the simplest means of detecting theft is to offer a reward for each detection by any employee."

"In the first two weeks more than 500 cases were reported."

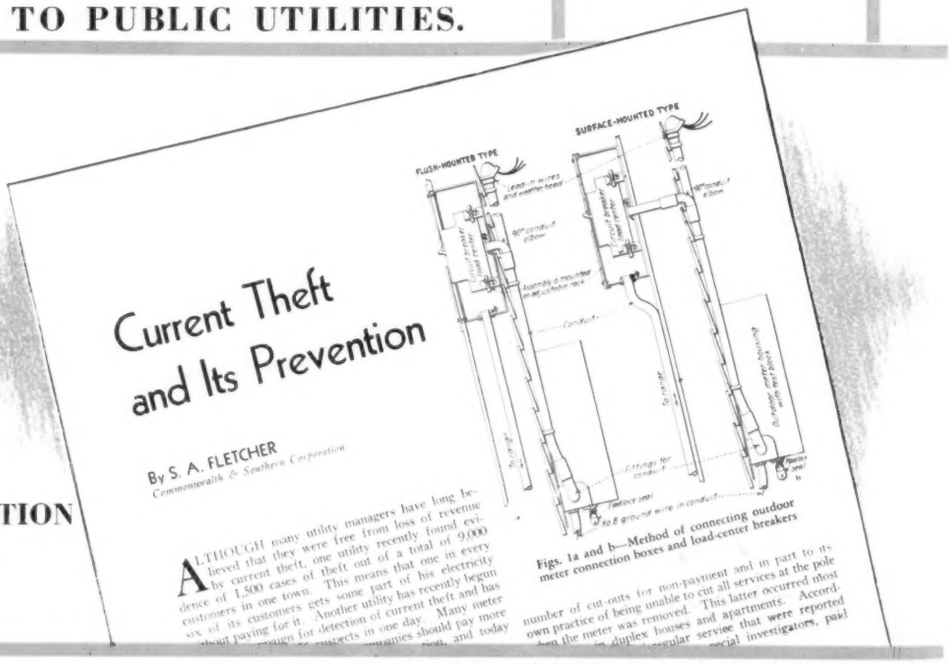
THE ABOVE QUOTATIONS ARE TAKEN FROM ARTICLE WHICH APPEARED IN NOVEMBER 21, 1931, ISSUE OF ELECTRICAL WORLD.



MURRAY PADLOCK SEALS
WILL PROTECT YOUR INCOME!
SOLD DIRECT TO PUBLIC UTILITIES.

For Complete Details of Real Seal Protection, Write

METROPOLITAN DEVICE CORPORATION
1250 ATLANTIC AVE.
BROOKLYN, N. Y.



Current Theft and Its Prevention

By S. A. FLETCHER
Commonwealth & Southern Corporation

ALTHOUGH many utility managers have long believed that they were free from loss of revenue by current theft, one utility recently found evidence of 1,500 cases of theft out of a total of 9,000 customers in one town. This means that one in every six of its customers gets some part of his electricity without paying for it. Another utility has recently begun a campaign for detection of current theft and has found suspects in one day. Many meter companies should pay more attention, and today

SURFACE-MOUNTED TYPE
FLUSH-MOUNTED TYPE

Figs. 1a and b—Method of connecting outdoor meter connection boxes and load-center breakers

number of cut-outs for non-payment and in part to its own practice of being unable to cut all services at the pole when the meter was removed. This latter occurred most often on duplex houses and apartments. Accordingly, regular service that were reported [illegible] special investigators, paid

from Electrical World, Nov. 21, 1931

ELECTRICAL WORLD

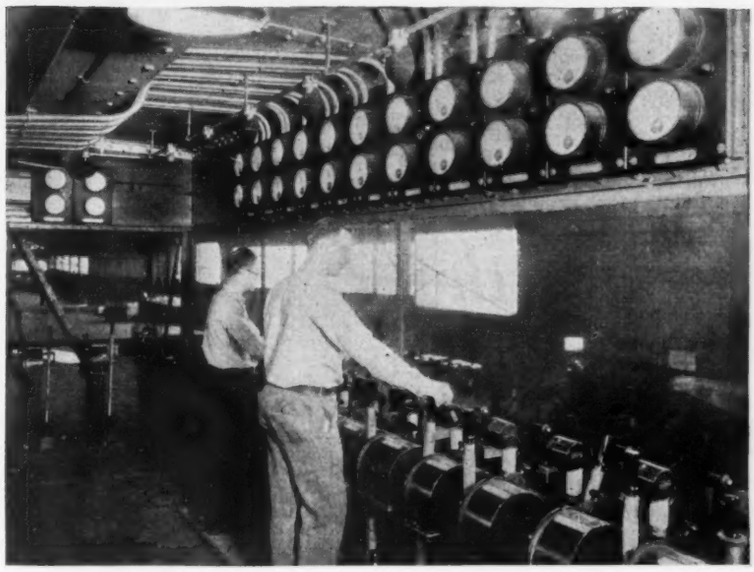
A consolidation of Electrical World, Electrical Engineer and American Electrician

L. W. W. MORROW, *Editor*

ALLEN M. PERRY
Managing Editor
EARL WHITEHORNE
Contributing Editor
G. F. WITTIG
Statistical Editor
H. M. CAMERON
Associate Editor
A. E. KNOWLTON
Associate Editor
F. C. WELLS
News Editor
E. R. SEARLES
Assistant Editor

FRANK R. INNES
Western Editor
520 N. Michigan Ave.
Chicago
H. S. KNOWLTON
New England Editor
1427 Statler Bldg.
Boston
WALTER C. HESTON
Pacific Coast Editor
883 Mission St.
San Francisco
PAUL WOOTON
Washington
Correspondent
National Press Building
Washington

JAMES H. RUDD
Publishing Director



Operating pulpit 12-in. hot strip mill, Sharon Steel Hoop Co.

JANUARY 16, 1932

Contents, Copyrighted, 1932, by McGraw-Hill Publishing Company, Inc.

VOLUME 99 . . . NUMBER 3

Financial Practices of Few Endanger Utilities' Credit 134
By W. C. GILMAN, *New York, N. Y.*

Proof Testing of Cables Justified 137
By CHARLES H. SMITH, *Edison Electric Illuminating Company of Boston*

Part-Winding Starting for Synchronous Motors 142
By C. R. ZIMMERSCHIED, *Electric Machinery Manufacturing Company*

Engineering Data Sheets Simplify Purchasing 146
By RUSSELL C. WENZ, *Byllesby Engineering & Management Corporation*

Metal-Clad Switchgear Selected for Economy and Merit 149
By L. GRIGSBY AND R. T. WOODRUFF *Public Service Company of Oklahoma and Westinghouse Electric & Manufacturing Company, Respectively*

All the Comforts of Home for 3 Cents an Hour 152
By DEAN W. TAYLOR, *Utility Management Corporation*

News of the Industry 117
Editorials 130
Bus Spacings and Ground Clearances 136
Floodlighting Installations as Load Builders 136
A Surgeon's Message to Utilities 140
Trailers Meeting Heavier Demands 141
Coupling Condensers Provide Directional Relay Current 145
Regenerative Drag for Sheet Mill 148
Guide to Pole Selectives 151
Matching Ratio Errors Improves Differential Relaying 154
Group Erection with Crane Saved Time, Reduced Hazard 155
Readers' Forum 155
Men of the Industry 157
New Equipment Available 160

Electrical World articles are indexed in Industrial Arts and Engineering Indexes, available in public libraries

McGRAW-HILL PUBLISHING COMPANY, INC., 330 WEST 42d STREET, NEW YORK, N. Y.

CHICAGO, 520 N. Michigan Ave. 883 Mission St., SAN FRANCISCO Aldwych House, Aldwych, LONDON, W.C. 2

JAMES H. McGRAW, Chairman of the Board
MALCOLM MUIR, President
JAMES H. McGRAW, JR., Vice-Pres. and Treas.
MASON BRITTON, Vice-President
EDGAR KOBAK Vice-President
H. C. PARMELEE, Vice-Pres. and Editorial Director
HAROLD W. McGRAW, Vice-President
C. H. THOMPSON, Secretary

Published weekly. $5 per year. 25 cents per copy. Foreign, $9 U. S. currency, or 45 shillings, per year. Canada subscription price (including Canadian duty), $7.50. Entered as second-class matter, January 20, 1907, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

CABLE ADDRESS: "MCGRAWHILL, N.Y."

Member A.B.P. *Member A.B.C.*

NUMBER OF COPIES PRINTED THIS ISSUE, 16,750

WASHINGTON, National Press Building
PHILADELPHIA, 1600 Arch Street
CLEVELAND, 501 Guardian Building
DETROIT, 2-257 General Motors Building
ST. LOUIS, 1556 Bell Telephone Building
BOSTON, 1427 Statler Building
GREENVILLE, S. C., 1301 Woodside Building
LOS ANGELES, 339 Chamber of Commerce Building

ORANGEBURG FIBRE CONDUIT

TIME-TESTED IN 39 YEARS' SERVICE

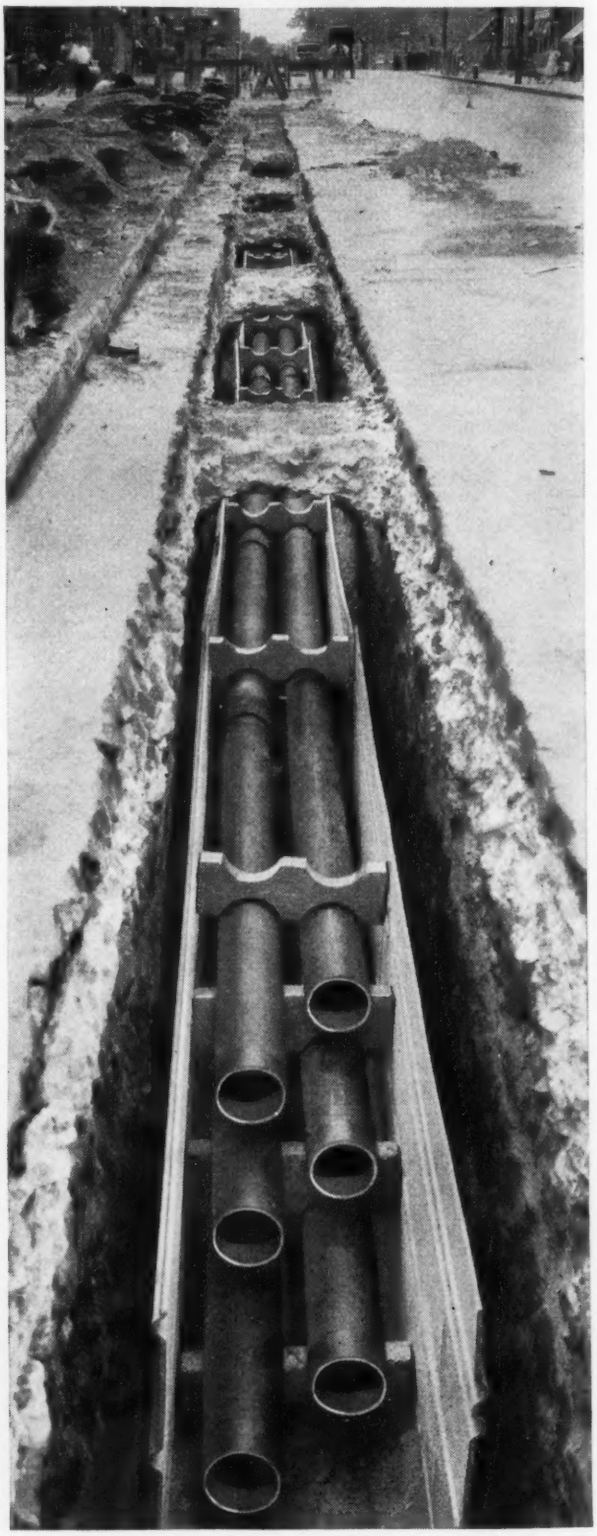
Your cable subway joints must be tight —*but are they?*

EVERY JOINT in a cable duct system is a possible cause of cable damage. Unless duct joints are tight, wet concrete may seep in during pouring and form sharp abrasive projections, dangerous to lead cable sheaths; corrosive soil waters leak in; openings are present to cause electrolytic or stray current damage.

Orangeburg Conduit has only one joint per eight feet. Its taper-sleeve joint, set up with a twist of the wrist, permanently closes the joint against wet concrete or trench débris and reduces the possibility of electrolytic or stray current damage.

• • •

Orangeburg Fibre Conduit really does the job it is supposed to do. At low cost it assures permanent trouble-proof protection to underground cables. Thousands of miles of Orangeburg Conduit are being used as standard construction in the foremost underground distribution systems now in operation.



Large stocks carried in manufacturing plants in Orangeburg, New York and Richmond, Indiana, as well as in all larger cities make it possible to fill orders from any part of the country promptly and completely.

The Fibre Conduit Co.
ORANGEBURG, N. Y.

SOLE SELLING AGENT **Johns-Manville** 292 MADISON AVE., NEW YORK CITY

ELECTRICAL WORLD

Established 1883. McGraw-Hill Publishing Company, Inc.

for the Week Ending

January 16, 1932

N.E.M.A. agrees on range program

—**Attack upon the home market** to be made with organized electrical industry united for common good if proposed scheme is carried to a successful completion. Goal is sales of 1,000,000 ranges in three years—*p. 115.*

—**10,000 kw.-hr. in rented home** was utilized in one year by a customer of Staten Island Edison. Promotional rate brought cost to 2.54 cents a kw.-hr. average and led to full use. Appliance value totals $1,217—*p. 152.*

Power trustees seek competition's aid

—**St. Lawrence Authority asks,** in its report to Governor Roosevelt, for competition, or threat of it, which will insure low charges for energy distribution. Municipal plants, power districts, etc., suggested—*p. 121.*

—**Finance of holding companies** should be strictly ethical, avers adviser to large investing institutions who sees risks to industry in use of operating-company credit to secure funds to loan holding companies—*p. 134.*

Midland United cuts corporate units

—**Simplifying through mergers** proceeds. A little over a year ago there were thirteen corporations in a group; these have now been reduced to two. Part of general Insull program to reduce complexity—*p. 123.*

—**Periodic proof test of cable** is fully justified by the results is conclusion of Boston Edison engineer. Failure of but 11.9 in 100 miles is offered as evidence of improved performance under test plan—*p. 137.*

Cities Service Building in New York,
with some interesting engineering features, including double-deck elevators, takes its place among the world's five or six tallest structures—*p. 129.*

One Million Electric Range Sales Is N.E.M.A. Program for Three Years

Feature of Annual meeting.

A $200,000,000 marketing program.

A $12,000,000 national advertising program for electric cooking.

Trumbull announces unemployment plans.

A MILLION electric range sales in the next three years! This is not a dream or a vague hope. It is the seriously adopted program of the electrical industry. It has been accepted as a practical goal. Laying out the campaign was the highlight of the most enthusiastic midwinter meeting the N.E.M.A. has held in years. It is without a doubt the key to business recovery in so far as the electrical industry is concerned.

How is this prodigious task to be accomplished—it took the past fifteen years to sell a million electric ranges? The answer was given by various members, principally H. J. Mauger of the Edison Electric Appliance Company, Chicago.

Characterizing the undertaking as the turning point in the N.E.M.A.'s history, Mr. Mauger declared that the objective is really more than merely to tap a $200,000,000 market. It is to raise the market another hundred million, resulting in a continuous annual volume of $100,000,000. The residence field, Mr. Mauger said, offers the greatest opportunity of any today. The present yearly average use of 550 kw.-hr. can be expanded to 1,500 or 1,800 kw.-hr., and future development is virtually unlimited.

Not only will the range section benefit, but virtually every branch of the industry will reap added business from the program. The sale of every range for $117 means that the switch and outlet producers get $7 or $8 and the meter manufacturer $7. Wiring costs are around $50 and the electrical manufacturer gets $20 of this. The transformer takes around $15, distribution equipment costs $9, substation costs are $18, while generation and transmission requires the remaining $40. Furthermore, from the power company's standpoint, the installation of one range is the equivalent of the addition of four lighting customers.

The first step in the program is the education of the public to the merits of electric cooking. Public acceptance of the principle is to be carefully developed. In this the National Electric Light Association has pledged its co-operation. A fund of $3,670,000 will be needed initially and a total of over $12,000,000 will be spent by all groups in the three-year period. The public must be just as thoroughly "sold" on electric cooking as it now is on electric illumination, and so must sales groups, it was urged.

That the goal is not an impossible one is seen from the fact that certain sections of the country, in the Northwest for example, are now as much as 30 per cent saturated from the standpoint of electric cooking. Taking the nation as a whole, saturation amounts to 5 per cent. The program outlined would merely bring this saturation up to 10 per cent. A 30 per cent saturation throughout the country would involve the sale of 6,000,000 ranges.

Basing his argument on the premise that most popular ideas about electric cooking are erroneous, Marshall Adams of the Westinghouse Electric & Manufacturing Company swept aside all the objections and built up an exceedingly strong case for the electric range. It is not slow, he said, but compares in actual speed with any type of cooking. Nor is the cost excessive. At a 3 or 4-cent rate current cost is only 1 cent per person per meal. That means around $4.55 a month. And central stations will be encouraged to introduce progressive rates more generally. He discussed electric cooking from every angle, and if any one left the meeting unconvinced he certainly hadn't been listening to Mr. Adams.

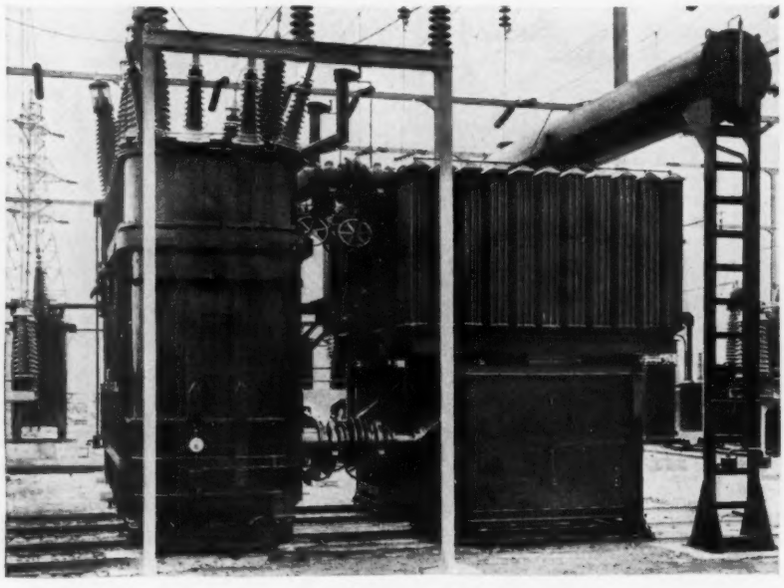
Several other speakers were called on to discuss various angles of the situation. They were Messrs. Quinn of General Electric Company, Palmer of General Cable Corporation and Sawin of Westinghouse. President Trumbull presided.

Trumbull discusses Swope plan

The largely attended dinner Tuesday evening was addressed by President Trumbull, who pointed out the need for collective effort and a point of view that would meet the needs of the average citizen of this age. In this aspect he stated conclusions as to the Swope plan as follows:

The plugging, every-day citizen, by his heroic manner in this great depression, has moved into the foreground and has drawn attention to certain features of his living which were entirely overlooked while the whole world was dizzy with its unprecedented prosperity. Industry now, through that workable tool born of the brain of Mr. Swope, can help this little fellow who is holding on by the skin of his teeth and who still believes there is something worth saving in the American system. It seems needless for me to expound the Swope plan at this time. Most of us are familiar with it—the most publicized plan yet forthcoming in the United States. Comments on it

OIL-COOLING AUXILIARIES SERVE THIS TRANSFORMER



With the avowed purpose of increasing reliability and economy Brown Boveri & Company, Ltd. (Switzerland), have provided this 32,500-kva., 10.5/48/116/145-kv. transformer with an auxiliary oil cooler. Blowers in the base of the cooling unit force air through nozzles below the vertical radiators.

have been varied, but few are fundamentally hostile.

Its unemployment insurance feature has received the careful study of a committee of N.E.M.A. appointed for that purpose, and I am delighted to be able to report that there are good reasons for hoping very shortly for an announcement to the effect that unemployment insurance will be adopted by some of the larger electrical concerns. And thus the electrical industry will have been the first group of manufacturers take a definite stand to help that American citizen whom I have tried to picture to you.

It is not unexpected that the experience of these electrical companies with unemployment insurance will encourage more members of N.E.M.A. to fall in line, as well as other groups of industry. As more and more companies include unemployment insurance as part of their operative plan, we shall come nearer the goal of having solved one problem that is essentially industry's problem, and which can be solved by business interests, but which cannot be solved by the principles of communism.

The Swope plan committee of N.E.M.A. is ready at all times to be of whatever assistance it can to any company interested in protecting its employees with unemployment insurance, and the committee earnestly hopes that it may have many calls for its services.

▼

Wisconsin's Regulatory Law Is Finally Upheld

While the Wisconsin Legislature was engaged in so amending the utility act passed by it last year as to remove an obstacle to its operation placed by a court of first instance at the suit of a telephone company, the State Supreme Court, to which appeal had been taken, somewhat unexpectedly overruled the lower court and dissolved the injunction granted by the latter against enforcement of one clause of the act.

The clause at issue, as already reported by the ELECTRICAL WORLD, authorized the commission to assess at its discretion all, part or none of the expense of investigating rates against the utility complained of according to the regulatory body's view of the utility's culpability. The Circuit Court of Dane County said that this was a legislative and not an administrative function and that therefore the clause vesting it in the commission was unconstitutional. The Supreme Court, although asserting that the law is "not happily framed," finds that the power of the commission to make reasonable determinations upon situations as they arise, subject to judicial review, is an administrative and not a legislative power.

In the Legislature a substitute to the bill designed to remedy the supposed legal defect which would have made a flat appropriation to cover all commission expenses was defeated by a majority of one. An amendment was also introduced to limit the charges to be made against any utility investigated to 1 per cent of its gross revenues instead of 5 per cent.

Another ruling handed down by the Supreme Court at the same time as the one referred to is to the effect that street railway systems must pay their own way and cannot be supported by profits from power systems.

▼

North American Company Before Trade Commission

The North American Company, which was investigated by the Federal Trade Commission in the first half of last year, was again on the carpet on Tuesday of this week, when the commission took up for inquiry the public utility properties in California which the holding company just named formerly owned, but which since July, 1930, have been owned by its erstwhile competitor, the Pacific Gas & Electric Company. These operating organizations are the Great Western Power Company and the San Joaquin Light & Power Corporation with its affiliate, the Midland Counties Public Service Corporation.

Judson C. Dickerman, engineer-examiner for the commission, praised the regulatory methods of the California Railroad Commission, ascribing to that body and to competitive conditions on the Pacific Coast the prevalence of economy in investment and of low rates. He said that valuation for rate making "has been based on the actual costs of installing the property, without allowances for going value and with insistence upon positive depreciation allowances. Thus write-ups of property accounts and security issues without actual investment costs behind them have been impossible and useless."

At the conclusion of Mr. Dickerman's testimony, the commission announced that it will resume hearings on January 28, when it will once more take up for inquiry companies of the Middle West Utilities Company system.

▼

Sodium Vapor Lamp Reported Greatly Improved

Development by Dr. Pirani of Berlin of a sodium resistant glass which is suitable for forming the envelope of sodium vapor lamps, thereby eliminating the blackening or darkening formerly encountered with this type of source, was announced this week by Dr. H. C. Rentschler of the Westinghouse Lamp Company at a meeting of the New York Electrical Society. High efficiencies as a light source are claimed for the sodium lamp.

General Business Still Somnolent

CAUTIOUS hesitancy characterized business and industry the first two weeks of 1932. Steel production registered a slow rise early in the new year. This was reversed by a 198,000-ton decrease in unfilled orders of the United States Steel Corporation in the second week, leaving the total of unfinished business the lowest since 1910.

Electrical equipment business is still working on a greatly curtailed basis as a result of contracted utility budgets. Manufacturers are optimistic on potential range business and are laying the foundation for aggressive development of this field. Electric power production has fallen off as a result of lessened industrial activity.

Promised expansion of construction and building operations has not yet materialized. Many large projects are on paper, but it is uncertain when operations will commence. Judging from current market conditions many branches of industrial activity will be seriously handicapped for some time as a result of inability to secure new capital.

Beat St. Paul Franchise Five to One at Polls

Following a heated campaign in which vigorous attacks were made on the Northern States Power Company on the stump and in the newspapers, citizens of St. Paul went to the polls on Tuesday and defeated by 42,825 votes to 8,760, or almost five to one, three new franchises proposed for that company in consideration of which, had they been adopted, St. Paul light and power rates were to be put on an equality with those of Minneapolis. The proposed franchises gave the company the right to use streets and alleys in the city for 20 years for electric, gas and steam service. The clause that aroused the strongest opposition was that eliminating a 5 per cent tax on gross earnings hitherto collected.

In Marshall, Minn., on the same day the voters rejected by thirteen to one a proposal to sell the municipal steam-electric plant to the Northern States Power Company, the poll being: For the sale, 99; against, 1,285. The price offered by the company was $600,000.

▼

New York Metal Prices

	Jan. 7, 1932 Cents Per Pound	Jan. 13, 1932 Cents Per Pound
Copper, electrolytic	7.25	7.50
Lead, Am. S. & R. price	3.75	3.75
Antimony	6	6
Nickel, ingot	35	35
Zinc, spots	3.45	3.40
Tin, Straits	21.13	21.70
Aluminum, 99 per cent.	23.30	23.30

CANADIAN SUBSTATION LOOKS FINE—BUT THE PROVERBIAL FLY IS NOT ABSENT!

The Toronto Hydro-Electric System is to be congratulated on the splendid architecture of its new 25,000-kva. Glengrove substation built on Yonge Street for heavy residential loads. If only the overhead power lines bulked less large this would appear to be the almost-perfect job from the citizen's viewpoint.

▼

Seattle City Plant Not in Straits, Ross Asserts

Superintendent of City Light explains circumstances that led to exaggerated reports

To a news article printed in the ELECTRICAL WORLD for December 19, (page 1071) under the heading "Seattle City Light Is Hit by the Hard Times" Superintendent J. D. Ross of the Seattle City Light Department takes vigorous exception, declaring that the department is not "harassed by creditors" and has not got "its back to the wall," as asserted in the item referred to. The ELECTRICAL WORLD, which in printing the article was actuated by no desire to attack or injure the Seattle enterprise, but merely regarded it as an interesting news item showing that even the largest and most successful municipal plants were not immune from the deplorable industrial conditions now prevailing, is glad to give at length a résumé of Superintendent Ross' statement of the facts as he sees them.

It is true, Mr. Ross says, that the department has not sold any bonds since September, when a syndicate of bond houses paid $1,932,000 for $2,000,000 of the $4,000,000 in 5 per cent bonds then offered, reserving the option to take the other $2,000,000 within 60 days, which option they allowed to expire. By that time the city found that, in common with other cities and governmental agencies, it was impossible to sell bonds at a proper figure and made no additional calls for bids. By consequence it met due obligations for machinery and cable purchased for the Diablo development by warrants, but, strictly speaking, the department is not "on a warrant basis," since employees are being paid and other current operating obligations are being met in cash. A balance of about $1,250,000 is owing, but not now due, for these purchases. This will come due within the next six months. An emergency therefore exists, but not such a critical one as readers of the ELECTRICAL WORLD may have been led to believe.

Referring to measures under consideration for raising money, Mr. Ross said that officials and employees volunteered to take a 25 per cent decrease in wages, but that this expedient was not deemed necessary and was refused. Outdoor employees, both union and non-union, are rotated in employment and are paid full scale for the time they work. Some employees working full time have voluntarily asked for a 10 per cent decrease to be fair to those employed part time.

For one city department to loan to another to save interest charges has been common practice in the past and may be resorted to, with "City Light" as borrower, to assist in the present emergency. As regards selling bonds over the counter, repeal of the city ordinance requiring bids on bond issues would make this legal, and it is estimated that $1,000,000 in bonds could be sold throughout the state in this manner without creating a selling organization.

Mr. Ross answers the statement that there is no money to build the Diablo power house and transmission line by stating that the work was called off primarily because of the drop in business experienced by City Light in common with other electric utilities so that haste to complete this part of the Skagit project became unnecessary. Kilowatt-hour output for 1931 was 5 per cent below that for 1930. However, if it is desired to go ahead in the immediate future, no money will be needed, since several contractors have offered to complete the power house and take bonds instead of cash. This method was employed when the Gorge plant was built, contractors being required to take their contract prices in bonds and pay cash for additional bonds in the amount of $1,000,000.

▼

No Drought in Oregon Likely in Current Year

Water shortage in Oregon during the coming dry season will have little or no effect upon either hydro-electric power operators or the irrigationists, according to the latest records compiled by the State Engineering Department. Extended rainfall, together with the occurrence of very heavy snowstorms in the mountainous region of the state during the past two months, is likely to prevent any serious lack of water in Oregon, those in charge of the state Department of Meteorology predict. The estimated plentiful supply of water for the current year marks a welcome break in what has been a five-year period of annual water shortage in this and other states in the Northwest.

Competition Necessary in Distributing St. Lawrence Energy, Trustees Say

QUESTIONS connected with the distribution of the energy that will be produced by the state plant on the St. Lawrence River, if and when it shall be built, form the most suggestive part of the interim report by the New York State Power Authority to Governor Roosevelt, made public the first of this week. Under the heading "Study of Economic and Engineering Problems" the report, which is signed by Chairman Frank P. Walsh and Vice-Chairman Delos M. Cosgrove, says:

It has become apparent that the volume of cheap power to be made available by this development is so great as to make the manner of its disposal really vital to the social and industrial progress of our people. In fact, the relative importance of the St. Lawrence in the whole scheme of electrical development necessarily imposes upon the Power Authority many of the duties of a state power-planning board. Our purpose will be to dispose of this great asset so as to affect most favorably social, economic and industrial progress both now and in the future. In these inquiries we are having the advice and assistance of a wide range of expert engineers, economists and accountants.

This is followed by a discussion of the "Negotiation of Contracts for Power Distribution," part of which reads:

In the conduct of these negotiations we have been forced to consider the fact that under existing conditions there is one corporation which occupies a peculiarly advantageous position in bidding for distribution of the enormous quantity of electricity to be generated by the state. The salutary force of competition, necessary to secure for the people and industries of the state the distribution of St. Lawrence power upon the most beneficial terms, must therefore be provided by constructive action on the part of the state itself. . . .

In order to provide the alternative possibilities of distribution which, we feel, will insure the consummation of fair contracts which will carry out the intent of the law, the Power Authority recommends the enactment of the bills permitting municipalities with the consent of their citizens to engage in the distribution of electricity and to form power districts for this purpose. Consideration should also be given to facilitating rural service by authorizing municipal plants to serve customers beyond corporate limits and by removing the obstacles to the operation of farmer mutuals, and otherwise.

With this potential alternative, the Power Authority is hopeful that contracts can be made in the near future which will be fair to the distributing companies and will also mean much lower rates to rural and urban homes throughout the state.

The report, which, it is predicted, will be sharply attacked by the Republican majority in the Legislature—particularly because of the implied threat to the Niagara-Hudson Power Company that, if it does not meet the Power Authority's views concerning rates, resort will be had to various forms of state and municipal ownership for distribution systems—says also that satisfactory preliminary negotiations have been conducted with the State Department at Washington and with the Hydro-Electric Power Commission of Ontario. The trustees lay stress on "the importance of beginning the actual work of construction at the earliest possible moment as a means of relieving unemployment and supplying the people and industries of the state with cheap electrical energy."

▼

No St. Lawrence Pact This Year Expected at Ottawa

Ottawa advices say that as the time approaches for the winter session of the Canadian Parliament it becomes abundantly clear that there is little probability of the government being in a position to submit a St. Lawrence waterway pact. It is felt in political circles that while the joint international board of engineers is still dealing with the principal technical question that has thus far prevented an agreement—namely, whether it should be a single-stage or a double-stage development—little real progress in the international negotiations can be expected.

The fear that Canada's share of the

▼

Coming Meetings

American Institute of Electrical Engineers—Winter convention, New York, Jan. 25-29; district meeting, Milwaukee, March 14-16. F. R. Hutchinson, 33 West 39th St., New York.

Conference of Electrical Leagues—Philadelphia, Jan. 25-27. Society for Electrical Development, 420 Lexington Ave., New York.

North Central Electric Association—Commercial Section, Lowry Hotel, St. Paul, Jan. 29 and 30; Engineering Section, St. Paul Hotel, St. Paul, Feb. 22 and 23. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

National Electric Light Association—Group committee meetings: Engineering National Section, New York, Feb. 1-5; Accounting National Section, Statler Hotel, St. Louis, Feb. 15-17. A. J. Marshall, 420 Lexington Ave., New York.

Process Heating Conference—Case School of Applied Science, Cleveland, Feb. 10-12. W. R. Veazey, Case School, Cleveland.

Great Lakes Division, N.E.L.A.—Sales conference and Commercial Section, Edgewater Beach Hotel, Chicago, Feb. 18-19. R. J. Malcomson, 72 W. Adams St., Chicago.

National Association of Purchasing Agents—Public Utility Group, Birmingham, Ala., Feb. 18-20. G. A. Renard, 11 Park Place, New York.

Oklahoma Utilities Association—Tulsa, Okla., March 8 and 9. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City.

▼

IOWA-NEBRASKA'S NEW LINCOLN POWER STATION

Though the K Street station of the Iowa-Nebraska Light & Power Company in Lincoln, Neb., noted in the ELECTRICAL WORLD *for December 19 (page 1074), houses thus far only 10,000 kw. in equipment, it marks the steady growth of this operating utility, which now serves 246 communities.*

cost of the deepened St. Lawrence waterway (the international section) will not be much less than $250,000,000 is a deterrent to enthusiasm. Moreover, it is evident that so long as Premier Taschereau is directing the destinies of Quebec that province will be resolutely opposed to a project which, it is contended, would jeopardize its capital investment in hydro-electric energy. While the Ontario government has mildly commended the negotiations, that province is not prepared at present to take over and utilize Canada's share of the power to be made available.

▼

Navigability and Scenery Again Figure in Power Case

Once more questions of navigability and scenic beauty have been brought before the Federal Power Commission, this time in an attempt to influence its decision upon pending applications for preliminary permits on the Current River in Missouri. The applicants, whose claims conflict, are the Doniphan (Mo.) Hydro-Electric Company and the Current River Power Company of Kansas City, Mo. The State of Missouri opposed both applications at the hearing, saying that the Missouri Supreme Court had held the Current River to be nonnavigable and that a power plant would interfere with the attractiveness of a certain state park. Commissioner McNinch subsequently pointed out that Attorney-General Mitchell had ruled that the commission was not concerned with scenic questions.

The site designated by the Current River Power Company is at Hargus Eddy, 6½ miles above Doniphan. Representatives J. F. Fulbright of Doniphan and W. E. Barton of Houston, Mo., urged the commission to decide which of the two applicants was better able to start work immediately and to issue a permit without delay. United States Army engineers hold the river to be navigable and therefore under the commission's jurisdiction.

▼

Bilbo of Mississippi Sees Utility Menace

A parting shot at the public utility companies was taken by Governor T. G. Bilbo of Mississippi in his final message to the Legislature last week, before stepping down from the gubernatorial chair in favor of Governor-elect Mike Connor, when he said:

This Legislature can render no greater service to the people of Mississippi than in the immediate enactment of laws and measures properly regulating the public service corporations in Mississippi, with special reference to the regulation and control of the power and gas companies, both as to the rates charged the people for service and regulating stock manipulations of these companies, their bonds, etc. I have noticed with much interest certain efforts that are being made to control this Legislature, especially in reference to legislation to regulate and control the power companies. I want to warn you against the well-defined effort of the power companies to have their attorneys and employees write the laws to regulate and control them. It is hard for me to understand how any member of the Legislature could consent to vote for a bill to regulate and control the power companies as written by lawyers who are on the payrolls of these companies.

I submit for your consideration the passage of a law making it compulsory upon every member of the Legislature to file under oath a statement giving his connection with any public service corporation in the state at the present time or within the last five years.

A 5 per cent tax on gross sales of electricity and gas is one of the items in the new tax program submitted to the Legislature by Governor Connor's steering committee. This tax, it is estimated, would yield $450,000 per annum. A substantial rise in the tax assessment of public utilities, excepting railroads, was recently made by the state.

Institute Program Covers Research, Theory, Practice

Late developments in the electrical engineering field will, as usual, be the themes of many papers to be presented before the winter convention of the American Institute of Electrical Engineers at New York on January 25-29. In the realm of theory there will be sessions on instruments and measurements, electrochemistry and electrometallurgy, general circuit theory and various fields of research. Other sessions on protective devices, electrical machinery, electric welding, transportation and communication will combine theory with practical design and performance.

Four important symposiums will cover (1) distribution-circuit lightning protection, (2) power-station auxiliary drives, (3) system stability, and (4) time and time services. These symposiums have been developed through the close co-operation of operating companies, electrical manufacturers and technical committee activities. They will represent current practices and present valuable data.

A.I.E.E. Program for Winter Meeting

MONDAY, JANUARY 25

Afternoon. — Protective Devices: "High-Speed Distance Relay with Composite Impedance-Reactance Characteristics," S. L. Goldsborough and W. A. Lewis; "Theory of Oil-Blast Circuit Breakers," D. C. Prince; "Practical Application of the Oil-Blast Principle of Circuit Interruption," R. M. Spurck; "Developments in Arc-Rupturing Devices," R. C. Van Sickle and W. M. Leeds; "Extinction of A.-C. Arcs in Turbulent Gases," T. E. Browne, Jr. Instruments and Measurement: Papers by C. L. Dawes and A. F. Daniel; W. B. Kouwenhoven and Alfredo Banos, Jr.; R. W. Carson and P. MacGahan; C. M. Hathaway and R. C. Buell; C. W. La Pierre.

TUESDAY, JANUARY 26

Morning.—Symposium on Distribution-Circuit Lightning Protection: Papers by C. Francis Harding and C. S. Sprague; K. B. McEachron and L. Saxon; A. M. Opsahl, A. S. Brookes and R. N. Southgate; D. W. Roper; T. H. Haines and C. A. Corney; H. A. Dambly, H. N. Ekvall and H. S. Phelps. General Circuit Theory: "Equivalent Circuits—I," F. M. Starr; "Transient Oscillations of Mutually Coupled Windings," L. V. Bewley; "Geometrical Circuits of Electrical Networks," R. M. Foster; "Vector Theory of Synchronous Machines," Ivan H. Summers (posthumous).

Afternoon.—Symposium on Auxiliary Drive for Steam Power Stations: Papers by F. H. Hollister, W. Poole Dryer and L. W. Smith.

WEDNESDAY, JANUARY 27

Morning.—Symposium on Stability: Papers by W. C. Hahn and C. F. Wagner; C. F. Wagner and S. H. Wright; W. C. Hahn; S. B. Griscom, W. A. Lewis and W. R. Ellis; R. A. Hentz and J. W. Jones. Research: "Electrical Precipitation," A. W. Simon and L. C. Kron; "Radio Interference from Insulator Corona," F. O. McMillan; "Predetermination of the A.-C. Behavior of Dielectrics," J. B. Whitehead and A. Banos, Jr.; "Breakdown of Glass with Alternating Potentials," N. D. Kenney, A. M. Luery and J. D. Moriaty; "Relationships Among the Magnetic Properties of Magnet Steels and Permanent Magnets," K. L. Scott.

THURSDAY, JANUARY 28

Morning. — Electrical Machinery: "Induction Motor with Paralleled Rotor and Stator," A. G. Conrad and R. G. Warner; "Design of Damper Windings for Synchronous Motors," C. C. Shutt. Electrochemistry and Electrometallurgy: "Power Losses in Electrolytic Condensers," F. W. Godsey, Jr.; "Film Characteristics of Electrolytic Condensers," F. W. Godsey, Jr.

Afternoon. — Electrical Machinery: "Commutation as a Switching Phenomenon," R. E. Hellmund and L. R. Ludwig; "Equalizing Currents in the Armature of a D.-C. Machine," R. M. Baker; "Calculation of No-Load Damper-Winding Loss in Synchronous Machines," E. I. Pollard; "Sine-Wave Generators," L. P. Shildneck. Transportation: "Engineering Features of Three-Power Locomotives," F. H. Brehob and F. H. Craton; "Motors for 3,000-Volt D.-C. Multiple-Unit Cars," J. C. Aydelott; "Temperature Rise of Ventilated Railway Motor Armatures," D. A. Lightband; "High-Capacity Rectifier Efficiency Improved by Sectionalization," A. L. Atherton; "Preparing Substations for Electric Operation," L. B. Curtis.

FRIDAY, JANUARY 29

Morning.—Symposium on Time and Time Services: Papers by E. W. Brown; A. L. Loomis and W. A. Marrison; J. F. Hellweg; G. W. Janson; H. E. Warren.

Afternoon.—Communication: Papers by H. A. Affel; W. S. Gorton and R. W. Chesnut; W. C. Jones and A. H. Inglis; G. S. Vernam; M. H. Woodward and A. F. Connery; R. E. Smith and L. A. Kelley; L. A. Kelley. Electric Welding: "Forces of Electric Origin in the Iron Arc," F. Creedy, R. O. Lerch, P. W. Seal and E. P. Sordon; "An Improved A.-C. Arc Welder," A. M. Candy, "Developments in the Design of Arc-Welding Generators," K. L. Hansen.

Thirteen Midland United Units Reduced to Two

FURTHER simplification of the corporate and financial structures in the Midland United Company group has just been made possible by approval by the Public Service Commission of Indiana of the merger of the Indiana Electric Corporation into the Public Service Company of Indiana and the Wabash Valley Electric Company and the Attica Electric Company into the Northern Indiana Power Company, Robert M. Feustel, president of the Midland United Company, has announced.

The mergers will be accomplished by converting preferred and common stocks of the Attica Electric Company and Wabash Valley Electric Company into preferred and common stocks of the Northern Indiana Power Company, and preferred and common stocks of the Indiana Electric Corporation will be exchanged for common stock of the Public Service Company of Indiana.

These mergers are in line with the policy of the Midland United Company to simplify and strengthen the corporate structure by merging subsidiary companies into larger and stronger units, Mr. Feustel said, making possible operating economies which increase their financial stability and enable them to furnish more adequate and dependable service to customers. In addition, the financial structure of the merged companies will be materially strengthened.

These latest mergers reduce to two companies what constituted thirteen separate corporations only a little more than a year ago. On January 1, 1931, the Indiana Electric Corporation acquired the properties of eight small companies serving the same general territory in central and southern Indiana. It now becomes a part of the Public Service Company of Indiana, thus eliminating nine corporate identities. Merger of the two other companies into the Northern Indiana Power Company reduces the group of thirteen to two.

Territory divided logically

The principal electric and gas companies in the Midland United Company group now are the Northern Indiana Public Service Company, furnishing service across the northern part of the state; Public Service Company of Indiana, serving the central and southern part of the state; Indiana Service Corporation, serving towns in the eastern section; Northern Indiana Power Company, supplying service to a group of towns in central Indiana, and the West Ohio Gas Company, furnishing gas service in central western Ohio.

These five subsidiary companies are made up of what were only eight years ago 64 separate corporations. Many of these companies formerly operated properties which were unrelated and not interconnected with others. Since the beginning of the Midland United group in 1923, these companies have been acquired and, as rapidly as possible, combined into larger units and towns interconnected with transmission lines.

▼

German Utility Reduces Dividend

Directors of the Rhine-Westphalia Electric Power Corporation (Rheinisch-Westfalisches Elektrizitätswerk Aktien-Gesellschaft) have declared a dividend of $1.06 per share on the American shares, payable January 22 to holders of record January 15. On December 17, 1930, the company paid a dividend of $2.14 per share; on January 4, 1930, the dividend amounted to $2.16.

▼

Arizona Edison Notes Being Deposited

Announcement is made that 87 per cent of the one-year 5 per cent notes of the Arizona Edison Company's issue of $1,500,000 have been deposited with the Chatham Phenix National Bank and Trust Company to be exchanged for new two-year 6½ per cent notes. The one-year notes matured on December 1, but were not paid at the time because of inability of the company to refinance under market conditions. Exchanges are still being accepted by the committee, it has been announced.

▼

Reserve Board to Check Deflation?

HAVE the Federal Reserve banks launched a definite, aggressive anti-deflation drive? This interpretation is placed by some on action this week by the Federal Reserve Bank of New York in cutting its buying rate on bankers' bills below the open market rate, forcing acceptance dealers to follow suit. If this interpretation is correct, the effect will inevitably be felt in the securities markets as a check upon further forced liquidation.

Evidence of increased buying activity in the bond market continues. Prices have shown greater resistance to selling drives, and actual gains have been made in many cases, bringing averages up slightly. This is attributed especially to better sentiment arising out of hopes of what may be accomplished by the Reconstruction Finance Corporation, and the influence of better sentiment abroad seems to be making itself felt. The market for new capital issues, however, is still virtually inactive, while the power and light industry is faced with the necessity of raising over half a billion for refunding purposes alone.

Common stocks have been particularly inactive during the first fortnight of the year. Average of 50 power and light stocks is up slightly to 35.1 from 33.3 last week. It stood at 40 at the end of December. Quotations settled down again from the buoyant tendencies of a few days ago, when government relief action was being discounted, but the midweek brought a new upward move.

ST. PAUL BANK SIGN IS AN ARCHITECTURAL UNIT

This neon tube sign, atop the new 32-story First National Bank of St. Paul, pleasingly combines architectural harmony with full advertising value. Three identical units, facing different ways, are involved. The figure 1 is a 50-ft. character.

▼

Texas-Louisiana Power Placed in Receivership

At the instigation of the Stafford-Lowson Company of Fort Worth, a creditor, the Texas-Louisiana Power Company, subsidiary of the General Waterworks & Electric Company, has been placed in receivership along with eleven other subsidiaries. The Texas-Louisiana Power group is not large electrically. Its electric revenues in 1930 amounted to $2,007,867, out of total operating revenues of $3,888,509. The company owns and operates 37 fully equipped electric generating plants with a combined capacity of 26,132 hp., about 1,500 miles of high-tension transmission lines and over 1,139 miles of distribution lines. In addition power is purchased at wholesale from the Kentucky Utility Company and the Union Gas & Electric Company for the service of certain Kentucky properties.

The complaint cites that the company is obligated to a number of individuals and firms in an amount exceeding $2,700,000, all of which is unsecured and of which about $700,000 is due at the present time. The plaintiff states that the power company is unable to provide for its financial requirements of itself by borrowing on its own credit, and that by virtue of existing financial conditions the market for its securities has depreciated to such an extent that they are virtually unsalable. At the same time the bill of complaint shows that the company has physical properties valued at $30,000,000 and other assets worth at least $1,000,000 in addition to its debt.

The order of the court enjoined any action to impound or take possession of the defendant company or its subsidiaries and also enjoined any action to interfere with the possession or management of the property by the receivers.

▼

New England Power Subsidiaries Increase Dividend

Lowell Electric Light Corporation and Lawrence Gas & Electric Company, both units of the New England Power Association, have declared quarterly dividends of 90 cents, placing the stocks on a $3.60 annual basis, against $2.60 previously paid. The Lawrence utility paid the dividend January 13 on stock of record January 6, and Lowell paid its dividend on the same date on stock of record January 4.

Lahti Forms New House

Matthew Lahti, formerly vice-president and treasurer of Tenney & Company, Inc., with L. J. Ball and W. H. Lahti, announces the formation of the investment banking house of Matthew Lahti & Company, Inc., with offices at 251 Devonshire Street, Boston, Mass. Mr. Lahti has been in the investment banking business for about eighteen years and with his associates was for many years connected with the investment department of Charles H. Tenney & Company, Boston, prior to the acquisition of that company by the New England Power Association.

▼

North American Gas & Electric Cuts Dividend

Directors of the North American Gas & Electric Company have declared a dividend of 10 cents per share on the class A stock, as compared with 40 cents previously paid. An initial quarterly dividend of $1.50 per share was also declared on the $6 preferred stock. Both class A and preferred dividends are payable February 1 to holders of record January 15.

▼

Report Insull Secured $50,000,000 Short-Term Credits in New York

SAMUEL INSULL has declined either to confirm or to deny reports current recently that the Insull group had secured some $50,000,000 in short-term credits from New York and Chicago bankers. The alleged purpose was to meet maturing securities and notes of the Middle West Utilities group until long-term financing is again feasible. Mr. Insull stated to the ELECTRICAL WORLD that the finances of the system are in a satisfactory condition.

Rumor had it, also, that in addition to the alleged borrowing mission another purpose of a recent visit to New York by Mr. Insull was in connection with the introduction of a drastic program of economy which is expected materially to improve the earnings position of the group. Operating costs, it is said, are to be pared all along the line and new construction will be greatly curtailed.

Capital requirements of the Insull group this year for refunding purposes are around $60,000,000. While the market for long-term obligations, even of high-grade utilities, is not receptive at the moment, it is considered probable that this situation will adjust itself before many weeks. Funds for investment, it is believed, will be available in large volume just as soon as confidence begins to return.

Substantial progress has been made in recent years in the consolidation of the Insull properties in various states and in the simplification of capital structures. Large economies have been effected in this way, placing the system in a position to benefit from any improvement in business. Only last week further progress was made in this direction in the Midland United group when the Public Service Commission of Indiana approved consolidation of certain operating properties. Merger of the Indiana Electric Corporation into the Public Service Company of Indiana will be accompanied by the exchange of preferred and common of the former for common stock of the latter.

Preferred and common of Attica Electric Company and Wabash Valley Electric Company will be converted into corresponding securities of the Northern Indiana Power Company.

Consummation of these consolidations will reduce to two companies what constituted thirteen separate organizations only a little more than a year ago, it is stated.

Will Collect Complete Refrigeration Statistics

The collection of complete industry statistics was one of the subjects discussed at the meeting of the refrigeration division of N.E.M.A. held at the Book Cadillac Hotel, Detroit, recently. It is planned to assemble complete manufacturing and sales data.

The commercial practices committee reported that for the present the patents subcommittee would be disbanded and that the patent situation would be studied by an especially qualified executive who, after investigation, would make a report.

The same committee also reported that its subcommittee on traffic had held a meeting recently and discussed the Interstate Commerce Commission's ruling on freight rates. It was pointed out that as far as the refrigeration industry is concerned the proposed increase in rates will probably be 2 cents per 100 lb. for electric refrigerators, $3 per car for lumber and 2 cents per 100 lb. for sheet metal. These proposed increases, which were submitted for approval to the carriers, are temporary and for a period ending March 31, 1933.

▼

General Electric Stockholders Increase

The stockholders of the General Electric Company increased by 33,323 between December, 1930, and December, 1931. The total number of stockholders in December, 1931, was 150,073, the largest in the company's history.

The owners of common stock numbered 140,483 in December, 1931. Of this number a certain proportion also own special stock, and, in addition, 9,590 are owners of special stock only. A year earlier there were 107,025 owners of common stock, some of whom also owned special stock, while the number owning special stock only was 9,725.

▼

Domestic Air-Conditioning Equipment to Be Made

Major development that is commanding the attention of architects and builders, because of its influence in designing and planning, is the provision of complete and economical air-conditioning equipment for residences. Certain large companies are said to plan mass production and marketing of the small, low-cost domestic unit early this year.

Market analysts and builders foresee a potential national market for this equipment approximating $5,000,000,000. An interesting survey of the whole field of air conditioning has been prepared by the Holland Institute of Thermology in collaboration with Dr. E. Vernon Hill, past-president of the American Society of Heating and Ventilating Engineers.

▼

Allis-Chalmers Lowers Dividend

Directors of the Allis-Chalmers Manufacturing Company on January 8 declared a quarterly dividend of 12½ cents on the outstanding 1,360,000 shares of common stock. This compares with a distribution of 25 cents per share in the preceding quarter, 50 cents on May 15 and August 15, 1931, and 75 cents per share each quarter from February 15, 1930, to and including February 16, 1931.

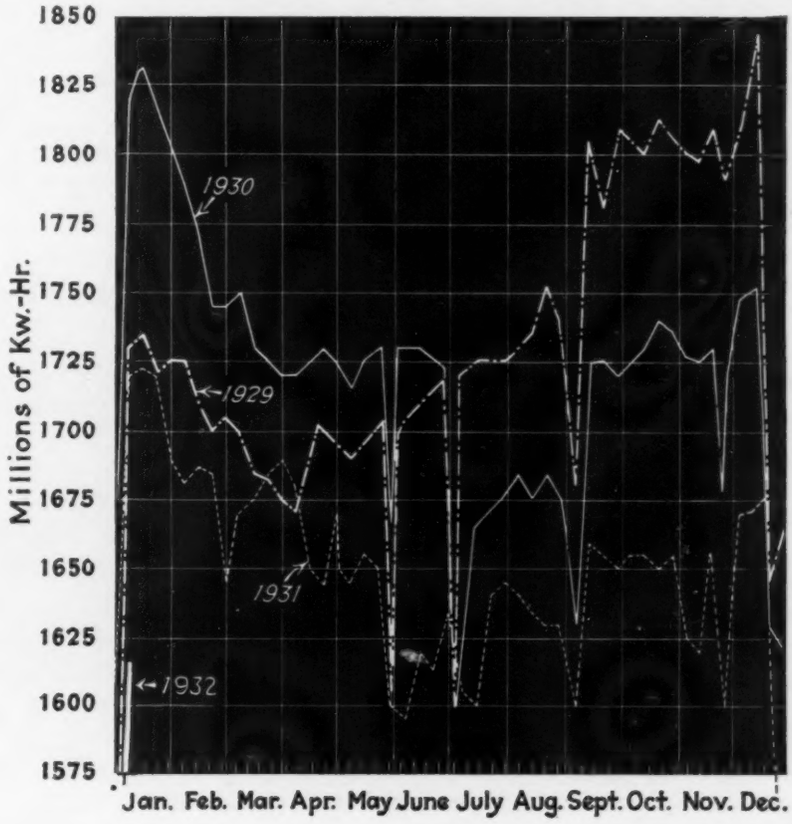
▼

Albert E. Peirce & Company Suspend Activity

Announcement has been made that all activities of Albert E. Peirce & Company, investment affiliate of the Central Public Service Utility group, have been suspended for the present owing to the unsatisfactory situation in the securities market. It is understood that the key men in the personnel of the organization have been retained and that the closing down does not involve liquidation, since the company has no indebtedness.

▼

Output Rises from Holiday Sag



ENERGY output of electric light and power companies for the week ended January 9 rose 6.2 per cent from the sag of New Year's week, but remains lower than in the first full week in January of last year. Comparable figures, in millions of kilowatt-hours, as reported by the National Electric Light Association are given in the table. The output during the past three weeks has been less than that of last winter, successively, by 3.3, 4.6 and 5.5 per cent.

The difference is not entirely caused by a change in industrial activity. Some of it appears to be due to deficiency of water power, especially on the Pacific Coast. More of the energy is generated by steam, near the load centers; less comes from remote hydro-electric plants over long transmission lines with their inevitable losses.

Compared with last year the decrease in per cent in New England was 2.6, the Atlantic seaboard 1.6, the central industrial region 7.8, Chicago district 4.1, the Pacific Coast 8.8.

	1931	1930	1929	1928
December 5....	1,671	1,747	1,806	1,706
December 12....	1,672	1,748	1,841	1,716
December 19....	1,676	1,770	1,860	1,710
December 26....	1,565	1,617	1,638	1,527
	(1932)	*(1931)*	*(1930)*	*(1929)*
January 2.....	1,524	1,597	1,680	1,542
January 9.....	1,619	1,714	1,816	1,734

December Marked by Automobile Activity—Average Declines

TRUE to past experience, the average of industrial activity in December was lower than in November. But the decline was somewhat greater than in 1930, 9.8 per cent compared with 5.2 per cent; whereas the recent November index was 5.5 per cent off from 1930, the December index was off 10 per cent.

The index numbers here given are based on returns received and compiled by the ELECTRICAL WORLD reporting energy consumption in numerous industrial plants throughout the country, different months being made directly comparable by adjusting for the number of working days.

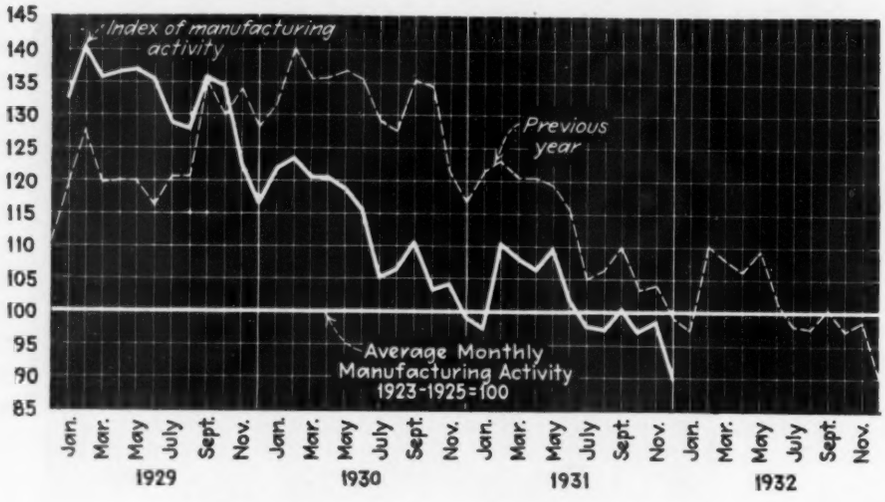
To get at the significance of the changes shown it is necessary to examine the returns for individual industries. Work in the making of automobiles, parts and accessories, which had increased in November from the October minimum, rose further in December, the total gain in two months being 36 per cent. There has been a gain also compared with 1930.

The food products industry, though down from November, is higher than it was a year ago. Leather gained by both comparisons. Textiles are at the preceding year's level and continue far above the low point of the summer of 1930.

It is the industries tributary to construction work that continue at a low level and that account for the low general average—iron and steel, metal working, forest products, the stone-clay-glass group.

Certain regional comparisons are also afforded by the table. New England is close to last year's level; textiles, one of the major industries, are down somewhat, but some others, notably paper and pulp, are up and her important metal-working industry is doing better than similar industries in other parts of the country.

In the Middle Atlantic States the relative rise in the food industry, in leather and in textiles partly balanced the year's decrease in the metal and earth-products groups. The latter—stone, clay and glass—is largely cement manufacture, appreciably affected by recently curtailed activity (normal in winter) of one important plant. In the North Central region textile operation rose over 1930, automobiles held, most other groups were down.



Index of monthly manufacturing activity

(Corrected for number of working days, but not for seasonal variation)

These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,800 large manufacturing plants in various industries and scattered throughout the nation.

Base Average Month, 1923-25 = 100

Industrial Groups	United States December, 1931	United States November, 1931	United States October, 1931	United States December, 1930	New England December, 1931	New England December, 1930	Middle Atlantic December, 1931	Middle Atlantic December, 1930	North Central December, 1931	North Central December, 1930
All Industry	**89.0**	**98.8**	**97.1**	**99.1**	**84.2**	**86.3**	**89.2**	**97.5**	**85.2**	**99.9**
Automobiles (including parts and accessories)	78.1	65.5	57.4	75.1	.....	.....	115.2	85.6	77.4	77.4
Chemical products (including oil refining)	117.0	138.0	142.0	133.5	128.5	120.4	123.1	140.1	96.6	141.9
Food products	124.8	144.0	136.5	107.1	.....	.....	107.2	64.5	112.8	112.2
Iron and steel	70.0	77.0	76.3	110.2	90.8	137.1	69.1	92.3	68.4	111.4
Metal working	70.9	76.0	71.0	97.8	93.2	104.5	61.2	102.5	69.4	78.7
Leather products	79.2	75.2	81.8	68.7	60.9	58.9	105.7	84.0	62.9	58.0
Forest products	67.0	76.4	81.2	73.3	42.5	39.1	42.0	108.0	77.3	99.8
Paper and pulp	107.0	126.1	113.0	117.0	134.2	96.0	86.8	91.0	74.6	94.1
Rubber products	79.2	93.5	82.8	84.3	73.2	80.9	.....	.....	85.0	90.7
Shipbuilding	94.6	95.0	84.5	99.0	.....	.....	.....	.....	.....	.....
Stone, clay and glass	69.0	113.8	113.4	106.4	.....	.....	54.2	91.0	77.1	90.7
Textiles	89.8	93.4	98.2	89.8	65.3	72.3	102.8	98.0	154.6	111.4

Carpenter Dam Plant Trying Out Equipment

Experimental operation of a part of the Carpenter hydro-electric generating station of the Arkansas Power & Light Company, on the Ouchita River, was started recently as a "tuning up" process for the equipment. The dedication will take place in the week of April 25, when the hundredth anniversary of Hot Springs National Park will be celebrated and the annual convention of the Southwestern Geographic Division of the National Electric Light Association will be held at Hot Springs.

Construction on Carpenter Dam and the hydro-electric station started in February, 1929. The dam is 1,164 ft. long at the apex with a height of 115 ft. It has created Lake Hamilton, which has an area of 7,150 acres. The plant is equipped with two waterwheels and generators, each capable of producing 40,000 hp. at full capacity. The development represents an investment of about $7,000,000.

Greater Building Activity in 1932 Indicated

Building construction will reach a grand total of $3,420,000,000 in the United States during 1932, according to the Copper and Brass Research Association. This represents a larger than normal increase in grand totals as compared with 1931, in which year the grand total was $2,509,000,000. These figures do not include public works.

The most important increase in volume of building is expected in the Central and Middle Western States. A shortage of houses in suburban sections of cities and in many small towns is expected to increase the building total in that territory by $200,000,000. Increased volume also is expected in New England, the Middle Atlantic and Southern States and on the Pacific Coast. In the New York area a drop is anticipated in commercial and industrial buildings, but this should be partially offset by residential construction.

According to the association's findings, the largest increase, taking the country as a whole, will be in residential building. There will be increases also in educational buildings, hospitals, public buildings, religious buildings and hotels, and a decrease in commercial, industrial and social buildings.

▼

Winter Construction Brisk on Beauharnois Plant

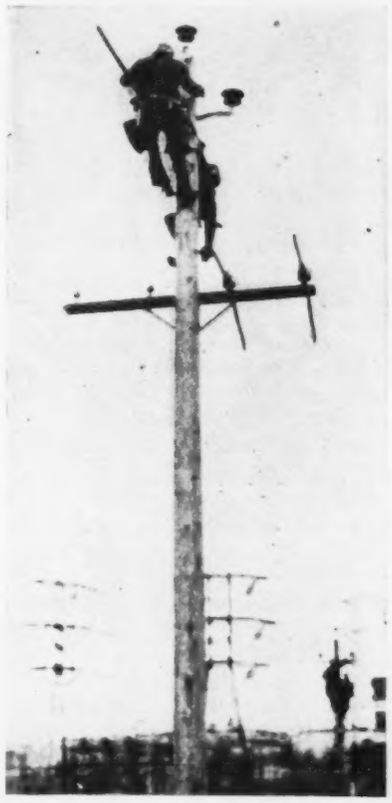
There will be little let-down this winter in the construction work on the Beauharnois power development, the corporation behind it announces. Last winter the number of men employed dropped down to 600, but during the coming three months the corporation will retain an average of 2,000 men on its payroll. The installation of the first two 50,000-hp. waterwheels has been completed, and the third and fourth are being installed. The first generator has been installed, and work on the other three 50,000-hp. units is under way. About 90 per cent of the rock excavation required for the full 500,000 hp. has been completed. The tailrace has been finished and water has been admitted covering the draft-tube outlets.

▼

Power and Irrigation in Washington

A power plant with an expected rating of 30,000 hp. is planned as an accessory to the 101-mile Yakima-Benton irrigation project to be undertaken in Washington State. The power plant will be at Union Gap, 1½ miles from the Yakima River. The project is expected to help finance construction.

Dummy Power Course as Linemen's Practice Ground



To train embryo linemen and to keep veterans safety-minded, as well as to familiarize both new and old linemen with the standard construction methods of the Niagara-Hudson system, the Chautauqua division of the Niagara, Lockport & Ontario Power Company has set up four poles in its Falconer (N. Y.) pole yard. Each line crew of the division is called in once a month for several hours of practice on this dummy course under the watchful eyes of a safety supervisor. Practice follows the safety rule book and includes the setting of poles, putting on of crossarms, guys, insulators and other hardware, and the stringing of wire.

▼

Electrolytic Hydrogen Produced at Lower Cost

The Consolidated Mining & Smelting Company has recently completed the installation of a battery of fourteen Pechkranz electrolyzer units, capable of absorbing 6,500 kw., at its new ten-million-dollar synthetic-ammonia plant near its Trail smelter in British Columbia. This is the first of several installations of this kind under way in America—the others being smaller—which may revolutionize hydrogen-producing practices on this continent.

The production of hydrogen by electrolysis is the only method in which purification—wiping out the advantage of directly lower-cost processes—is not necessary. With the electrolytic method, gas analyzing 99.5 to 99.9 per cent hydrogen is readily obtained. Disadvantages of the early and still commonly used cells have been the difficulty in preventing leakage of electrolyte and the necessary dismantling to replace defective diaphragms.

The cell process used by the Consolidated Mining & Smelting Company overcomes former objections and has been employed in Europe for some time, where it is said to function with notable success and economy. Perforated metallic diaphragms are

▼

Current Earnings Reports of Electric Light and Power Companies

OPERATING COMPANIES

	1931	1930	Per Cent Increase	Operating Ratio 1931	Operating Ratio 1930
Arkansas Power & Light (Year ended October 31)					
Gross earnings	$8,208,511	$8,835,091	— 7.0	53	54
Net earnings	3,851,700	4,097,106	— 6.0	..	..
Consolidated Gas, Electric Light & Power Co. of Baltimore (Year ended November 30)					
Gross earnings	25,949,843	25,945,313	0.0	59	60
Net earnings	10,674,537	10,335,229	3.3	..	..
Idaho Power (Year ended October 31)					
Gross earnings	4,361,192	4,127,694	6.0	47	49
Net earnings	2,287,762	2,114,948	8.0	..	..
Louisiana Power & Light (Year ended October 31)					
Gross earnings	6,236,780	5,998,626	4.0	50	52
Net earnings	3,112,557	2,862,732	9.0	..	..
Mississippi Power & Light (Year ended October 31)					
Gross earnings	4,999,190	5,020,897	— 0.0	63	65
Net earnings	1,855,715	1,737,869	7.0	..	..
Nevada-California Electric (Year ended November 30)					
Gross earnings	5,711,541	5,689,046	0.4	48	48
Net earnings	2,964,643	2,969,202	— 0.1	..	..
New Orleans Public Service (Year ended October 31)					
Gross earnings	17,627,670	17,474,591	1.0	63	61
Net earnings	6,417,519	6,307,563	2.0	..	..
Sierra Pacific Electric (Year ended November 30)					
Gross earnings	1,577,992	1,489,890	5.9	66	56
Net earnings	538,900	651,441	—17.2	..	..
Southern California Edison (Year ended November 30)					
Gross earnings	40,834,708	41,127,825	— 1.0	33	32
Net earnings	27,292,420	27,887,091	— 2.0	..	..
Tampa Electric (Year ended November 30)					
Gross earnings	4,313,335	4,606,898	— 6.4	51	53
Net earnings	2,089,334	2,134,992	— 2.1	..	..
Utah Power & Light (Year ended October 31)					
Gross earnings	10,730,646	11,454,482	— 6.0	47	45
Net earnings	5,712,614	6,310,716	— 9.0	..	..

HOLDING COMPANIES

	1931	1930	Per Cent Increase	Operating Ratio 1931	Operating Ratio 1930
American Water Works & Electric & subs. (Year ended November 30)					
Gross earnings	$50,407,819	$54,417,827	— 7.4	..	..
Net earnings	24,563,411	26,749,651	— 8.1	..	..
Associated Gas & Electric & subs. (Year ended November 30)					
Gross earnings	105,645,586	103,606,912	2.0	54	55
Net earnings	49,161,560	47,047,447	4.0	..	..
Eastern Utilities Associates & Constituent Cos. (Year ended November 30)					
Gross earnings	9,203,685	9,224,385	— 0.2	58	59
Net earnings	3,812,931	3,783,465	0.8	..	..

used, and deterioration is virtually eliminated. This permits realization of the full potential economies of the electrolytic process. At Notodden, Norway, a battery of such electrolyzers comprises 300 units, with 108,000-kw. load.

▼

Supreme Court to Hear Utility Case

Chief Justice Hughes has announced that the Supreme Court of the United States will hear the case of the Public Service Commission of Montana against the Great Northern Utilities Company, involving the right of a public service commission to fix minimum as well as maximum rates which a public utility may charge. The commission appealed from a temporary injunction restraining it from enforcing an order fixing a minimum rate to be charged by the company for supplying natural gas to the residents of Shelby, Mont. The company demands the right to lower its rates for the purpose of competition.

▼

Utility Merchandising in Oregon

January 18 is the date set by the Oregon Utilities Commission for a hearing involving the accounting practices of all central-station companies which market domestic electric appliances. The investigation was ordered upon complaint of the Oregon Electrical Appliance Merchants' Bureau, which alleges, among other things, that the power operators are maintaining appliance sales departments at the expense of the users of energy. The bureau also charges the utilities with taking undue advantage of the independent appliance dealers by making use of meter readers and other employees to sell appliances.

▼

Hydro Plant for Corinth, N. Y.

Plans for a three-million-dollar hydroelectric development by the International Paper Company at Corinth, N. Y., involving the construction of a dam creating a 6-mile lake in the Hudson, are in the preliminary stages. The company has obtained flowage rights. Edward H. Sargent, chief engineer of the Hudson River Regulating District Board, says that the scheme is part of the original purpose behind the construction of the Sacandaga Reservoir.

▼

Gets Interest in State Line Plant

Permission to the Northern Indiana Public Service Company from the Indiana Public Service Commission to acquire the interest of the Public Service Company of Indiana in the Chicago District Electric Generating Corporation, operator of the State Line generating plant near Hammond, Ind., is asked.

Rigid economy in governmental expenditures is a real road to relief, to home owners, farmers, workers, and every element of our population. We cannot squander ourselves into prosperity.
HERBERT HOOVER.

▼

The purchasing company proposes to pay $722,068 for the 71,760 shares, or 10 per cent of the no-par-value common capital stock of the generating company. At the time it acquired this stock, the Public Service Company owned electric properties in the north central portion of Indiana and needed to be assured that it could obtain energy for them from the State Line plant. Since that time the company has sold these properties to the Northern Indiana Public Service.

▼

New Utility Tax for Arkansas?

Petitions in favor of an initiated measure for taxing public utilities 3 per cent on their income from service, the proceeds to be used to retire existing indebtedness of school districts, are to be circulated in Arkansas. State Representative Harvey Thorn, sponsor of the measure, which embodies rates 50 per cent higher than those proposed by the same legislator last year, says that under his bill the companies cannot pass the tax on to the consumer. Electrical energy would be taxed 3 per cent except on that portion sold to customers who pay less than $1.50 a month. Mr. Thorn estimates that the tax would yield $2,400,000 annually.

▼

North Manchester, Ind., Appeals

As foreshadowed in the ELECTRICAL WORLD for December 19 (page 1073), the city of North Manchester, Ind., is appealing to the courts from the commission refusal to permit the municipality to condemn the holdings there of the Northern Indiana Power Company. The commission held that the company's property at North Manchester was not a separate unit but an integral part of its system. The city disputes this contention. The case is likely to be appealed to the Indiana Supreme Court, whichever side wins. It is arousing much interest among Indiana utilities.

Reducing the Irreducible Rate?

An order has been issued by the United States District Court at Fort Worth restraining the city of Floydada, Tex., from enforcing an ordinance reducing the electric light rates of the Texas Utilities Company about 20 per cent. The company declares that it earned only 1.9 per cent on its Floydada investment last year. It serves fifteen cities and towns of northwest Texas.

▼

Vancouver and Cheakamus River

Following a far-reaching survey of the Cheakamus River district, where for some years the city of Vancouver, B. C., has held a water-power reserve, E. A. Cleveland, Chief Commissioner of the Greater Vancouver Water District, has reported that the total cost of completing five hydro-electric developments there, to produce a maximum of 220,000 hp., would with transmission lines and substations approximate $28,500,000. Vancouver is served by the British Columbia Electric Railway Company.

▼

Injury to Ozarks Estate a Million?

B. Frank Bushman, president of the Federal Reserve Insurance Corporation of Kansas City, testifying as an expert on country estate valuations in a suit for $1,000,000 damages filed in the United States District Court at Jefferson City, Mo., by the Snyder estate against the Union Electric Light & Power Company of St. Louis, stated that a fair valuation of the Snyder property at Hahatonka, beauty spot in the Missouri Ozarks, prior to the building of the power company's hydro-electric dam at Bagnell on the Osage River was $1,379,850, while the present market value is but $179,260. Six thousand trees, worth $100 each, were destroyed, it is alleged.

▼

Attack Westchester (N. Y.) Line

Forty owners of estates in Westchester County, N. Y., have filed a complaint with the Public Service Commission at Albany protesting against the erection by the New York City Edison companies from Dunwoodie to Yorktown Heights of an overhead 132-kv. power line. The complaint declares that the erection of such a line, "to be carried by towers 81 ft. high and cutting a swath 200 ft. in width across the countryside, would not only depreciate real estate values and prove unsightly, but would also "menace the safety of residents of Westchester County and of all persons using the parkways and highways." The Westchester Board of Supervisors will also oppose the construction of the line as an overhead undertaking.

Nebraska Still Trying to Build Municipal Plants

A FOUR-CITY municipal electrical development in the North Platte Valley in western Nebraska is being attempted. The territory is now served largely by the Western Public Service Company. The plan, an attempt to put recent legislation to practical use, involves using water power created by enlarging an existing irrigation ditch. The cities concerned are Scottsbluff, Gering, Bayard and Minatare. Gering has a municipal plant. Bayard has voted six to one to join. Opposition has, however, developed in Scottsbluff, which is to be asked to issue $300,000 of pledge warrants.

The plan is being promoted by Denver men connected with a bond house that it to handle the sale of the warrants issued to finance the project. Under the law these are not obligations of the city, but are payable only out of earnings. Essentially the same plan was tried with disastrous results at several points in northeastern Nebraska, notably at Hartington, the city plants finally reverting to power companies operating in that section because of failure to make net earnings. Only a few rural extensions have been made by Nebraska cities having municipal plants, plants making this use of law being those at Fremont, Grand Island, Hastings, Madison, Falls City and Morrill. It was also claimed the law would give a 2-cent rate to farmers. No effort has been made to do this. Some small towns owning their own plants still maintain the old average rate of 15 cents.

Figures prepared by Thorne A. Browne, secretary of the Middle West Division of the National Electric Light Association, show that the law enacted by popular vote a year ago has, however, been effective in reducing the number of purchases of municipal power plants by transmission-line companies. While 34 towns sold their municipal plants between August, 1926, and August, 1928, and 63 from the latter date to the effective date of the new law in November, 1930, only three have been purchased since then.

In denying the application of Blue Hill for an order restraining the carrying out of an energy-supply contract between persons resident in and about Rosemont and the Southern Nebraska Power Company, the District Court held that a municipality seeking to extend its lines into unserved territory cannot exercise exclusive rights but enters such field upon equal terms with a privately operated power company. Rosemont is between Blue Hill and the town of Lawrence, served by the Southern Nebraska Power. Blue Hill desired to make use of the powers of extension granted to municipal plants by the Sorensen act. Before the board acted, the power company had obtained most of the possible contracts.

▼

Doherty Has Highest Utility Headquarters

Four distinct innovations in the operating equipment of skyscrapers are incorporated in the 67-story building for Henry L. Doherty & Company on Pine Street, New York, which is now virtually finished and is one of the five or six tallest office buildings in America.

There are double-deck cars for the high-rise elevators, escalators to serve the lower floors, a unit ventilating system drawing outside air over radiators beneath windows and forcing it through vertical wall ducts to horizontal ceiling ducts for delivery into the rooms, and a hot-water heating system for all stories above the first. (See page 117.)

▼

Mount Shasta Corporation Wins Pit River Appeals

A decision in favor of the Mount Shasta Power Corporation, a subsidiary of the Pacific Gas & Electric Company, has been handed down by the California Supreme Court in what are known as the Pit River water rights cases. The case had gone to the Supreme Court on appeal from the decision of the Third District Court of Appeals, which also had ruled in favor of the Mount Shasta Power Corporation, the appellate court having reversed the decision of the Shasta County Superior Court, which had awarded $85,000 to two plaintiffs (Albaugh and Crum) for damages alleged to have been suffered by lands riparian to the Pit and Fall Rivers (ELECTRICAL WORLD, November 7, page 807). The Superior Court also had granted an injunction prohibiting the power company from diverting waters from the Fall River, a tributary of the Pit, and the appellate court in reversing the lower court's ruling declared that the terms of the injunction were too drastic.

A total of nine cases of a nature similar to these suits have been filed against the power company, and the matter has been in litigation since 1923. Five of the nine cases already have been tried, with resultant verdicts against the power company totaling $270,000, including the $85,000 in the Albaugh and Crum cases. Because of the similarity between the two cases decided and the three still on appeal it is considered virtually certain that the same ruling will be made in the three cases. The damages sought in the four remaining pending cases amount to $190,000.

▼

Public Ownership for Quebec City?

The city of Quebec is sponsoring a bill in the provincial Legislature which would authorize it to municipalize the supply of electrical energy within the city limits.

▼

ELECTRIC WELDING EXPEDITES LAYING OF GAS PIPE

—Courtesy Lincoln Electric Co.

More than 120 miles of 26-in. gas-pipe line, from Kettleman Hills to Los Angeles, was 100 per cent arc-welded from 40-ft. lengths by eight crews in 112 nine-hour days. Expansion joints, gates, bypasses and all fittings are fused into a single unit. Tests were made in the field.

EDITORIALS

L.W.W.MORROW
Editor

Finance to the fore

PUBLIC utility bonds and notes maturing in 1932 aggregate $507,000,000. Of these securities, about $140,000,000 worth are in the form of one-year notes. This total of maturing obligations is the largest on record—twice the total of 1931.

In a securities market that is very thin and with a utility budget for new capital issues of $450,000,000, the utilities face the necessity of raising approximately $80,000,000 each month for refunding and new capital. Can this be done?

Their credit position is enviable. Earnings are at a maximum level and their financial condition is sound. Only one or two newly formed holding units have suffered collapse in the deflation market. But the sound earnings position has little effect upon the ability to finance at this time. Both investor confidence and investor funds are low for public marketing of any securities. The insurance group have about 30 per cent of their funds loaned to their policy holders. Investment trusts, banks and insurance companies have their portfolios filled with depreciated securities for which there is no market. All investment pools are glutted with "frozen assets." At this time, therefore, public issues of securities cannot be made on reasonable terms.

There are two promising approaches only. If the Finance Reconstruction Corporation about to be set up acts promptly, there is a possibility of creating an investment demand by a dose of inflation aggregating about $2,000,000,000. This may relieve the "frozen-asset" portfolios of the large investment groups. In the second place, a security market can be created by direct sales to customers and other individual investors.

About 60 per cent of the people have money in the banks or in deposit boxes that is earning little if any return. Instances can be cited to show that these individuals will buy good utility securities that will pay them a reasonable return. This is a permanent type of investor that pays little attention to stock markets and that has not been cultivated by investment houses. These investors have enormous purchasing power, and a sales mechanism should be developed to induce them to buy.

Aside from these two promising approaches, there is no favorable indication of an early sellers' market for securities. Action should be taken, therefore, to develop these possibilities, for a very artificial and unreasonable condition in the security market should not be permitted to jeopardize the ability of the utilities to continue their expansion.

Export tax sustained

IDAHO, South Carolina and Vermont passed laws last year placing a kilowatt-hour tax on electrical energy generated. In Idaho and South Carolina appeals to the courts were taken by utilities, and the first decision has come from Idaho, where the United States District Court has upheld the law as regards both energy used in the state and energy exported to other states.

The chief ground on which it is claimed that the tax on exported energy is unconstitutional is that transmission across state lines is interstate commerce. The Idaho court held that the generation of electricity is akin to manufacture and precedes transmission, that the energy can be measured before it enters transmission, and that therefore the tax does not interfere with interstate commerce.

Again the point of view came in. To the engineer there is no generation of electricity unless

there is a load. The wheels may turn, but there is no generation, and if the load is in another state, then the energy is a continuous stream across the boundary and the process of manufacture would be complete only if both load devices and generating devices were available to the energy circuit. Electricity is not a product that is made, shipped, stored and used at will. It is an intangible that occurs when both generating and utilization devices are connected so as to afford opportunity for energy to flow in a closed circuit in an amount that is determined wholly by the devices in the entire circuit. But engineers are not lawyers, and the court's finding prevails.

The institutional investor registers a protest

FINANCIAL policies and programs of the utilities to date have been determined largely by the judgment of utility executives and bankers. Most of the capital which constitutes the power and light industry's twelve-billion-dollar structure today was secured in sellers' markets. Utility credit has been high, and capital, especially toward the end of the bull market, came easily.

But the depression has ushered in a buyers' market, one which seems likely to last not only through 1932 but perhaps much longer. It involves among other things a more rigid credit scrutiny, especially on the part of the larger institutional buyers.

Of these larger institutional investors, legal-reserve life insurance companies are among the most prominent. Collectively they hold a stake of about two billion dollars in the utilities. Their voice is therefore an important one and is likely to become more important. It is inconceivable that the demonstrated sound judgment of utility executives should suffer so serious a lapse as to disregard this voice in future plans, in adjustments of capital structures, in intercompany borrowing and other fiscal relations.

Certain complaints expressed elsewhere in this issue are not confined to one institutional buyer. They express the opinion of several. Deliberately to jeopardize the industry's credit with this group would imply singularly bad judgment and would not be in tune with the far-sightedness characteristic of the men that have built up this industry.

Workings of the research mind

SINCE research is the foundation of electrical engineering, it is of surpassing interest to consider the type of mind which functions successfully in building the ever-widening and deepening base of technical progress. Addressing the Lowell Institute last week at Boston in the introductory lecture of a series on the application of science in electrical communication, Dr. H. D. Arnold, director of research for the Bell Telephone Laboratories, asserted that the type of mind which first sees that a problem exists is indispensable to research. The next step, evaluation, requires a mind that is constructively critical rather than creative—above all, a closely reasoning mind and one equipped with the tools of logic, which in engineering means the machinery of mathematics. All the available knowledge of physics, chemistry and mathematics must be brought to bear before profitable experimentation can begin. Next comes a side of the research mind closely in step with Nature herself—a mind which can cope with material things on their own ground, which has full understanding of instruments and their limitations, knows when to be bold and when cautious, linked with the experimental touch and familiar in the particular problem with all the technique, possibilities and pitfalls in carrying amplification to the limit, and measuring and establishing in the face of great experimental difficulties the actual magnitudes involved.

The mental approach to a research problem is many-sided. Foremost is the questing spirit which holds firmly to the solid ground of established fact while reaching out for unknown and untried positions, and yet so lightly that it swings on unhampered as soon as the new footing is found. This mind must be bold, curious, unbelieving, iconoclastic—perhaps not too scornful of present accepted beliefs but always eager for a different and better view. Then must appear the analytical mind to survey the new ground as it is won—a far more believing mind, which will not budge from established ground until firmly convinced there is real advantage in so doing. And finally, in Dr. Arnold's incisive words, research requires the mind of the husbandman, which moves into new territory with all the skill and research of engineering and checks and meas-

ures and cultivates all the new ground's possibilities.

The basic requirements, rarely possessed by individuals to a superlative degree, are the spirit to adventure, the wit to question and the wisdom to accept and use. The successful research man must have all these to some degree and apply them, but the essence of organized research is to give a greater freedom, a surer ground, a wider field and a more constructive expression to these types of mind.

Let's get down to earth

MILITARY strategists tell us the next war will be fought in the air rather than on the ground. Electrical technology seems to be headed in the reverse direction in its efforts to reduce line interruptions to zero. The campaign in the air has been quite successful. At least lightning has been well reconnoitered even though the defense against it has not reached the stage of complete invulnerability. That defense hinges on the ground and in the ground. The next drive will have to be aimed at taking the mystery out of grounding, if system protection is to be advanced in reliability.

True, there are other impediments to perfect system performance, but none lack so much in acceptance of common bases of qualitative significance and quantitative interpretation as grounding. The difficulty rests primarily on the absence of a lucid grasp of the mechanism of earth conductivity. Once that phenomenon becomes as familiar a process as the behavior of currents and charges in constrained metallic paths, then engineers will begin to construe the earth as an integral and component part of insulated systems which they are striving to protect.

In the meantime more study should be applied to the electrical properties of earth, both in the abstract and in the practical combinations of ranges of conductivity encountered, all the way from solid rock to marsh. Skilled analysis of the variable elements is sure to disclose the explanation of such anomalous occurrences as the reported case of lightning striking a tree and then spilling over from tower and ground wire to conductors. This, if substantiated, and many other kindred phenomena indicate that as much must be learned about the capacitive effects of ground in connection with high-frequency impulsive disturbances as has already been learned of its conductive behavior at lower or zero frequencies. In short, let's get down to earth.

How maintenance adds to capital expenditures

IN 1930 the utilities spent $960,000,000 on capital account and raised new capital to the amount of $1,214,092,000. In 1931 they spent $633,000,000 and raised new capital to the amount of $536,760,000. The budget for capital expenditures in 1932 is $454,000,000. These shifts in both capital spent and capital raised are explained by many things. The large expenditures of 1929 for expanded facilities were partly paid for by capital raised in 1930 and, in addition, 1930 capital covered part of the expenditures of 1931. There is a time delay in major construction, and both expenditures and capital issues reflect this situation.

But the figures for the 1931 and 1932 period are also affected seriously by security market conditions. During the latter part of 1931 the market was stagnant and thin, and it remains in this condition. Every effort is made therefore to hold down capital expenditures for 1932, because the money is difficult to raise and because load increases are not yet evident. Thus the budgets have been made on a minimum basis and are subject to revision almost every month as conditions regarding load and security markets change.

But these budgets are for added plant and equipment charged to capital account. They do not account for maintenance and operating expenditures, which in 1932 will aggregate about $1,000,000,000. For replacement of poles, remodeling of generating stations, substations and distribution systems and many other things money must be spent, and there is a wide divergence of opinion and practice as to whether this or that item shall be charged to maintenance or to new capital. Under the existing conditions it is safe to say that the pressure will persist to charge as much as possible to maintenance accounts. A true measure of expenditures for plant and equipment should therefore include maintenance as well as capital budgets.

30 foot-candles for Aetna offices

Foot-candle intensities in the new offices of the Aetna Life Insurance at Hartford, Conn., average 30 on the working plane in the typical section shown. Units were selected after tests of intensity, uniformity, absence of bright spots, reading speed (the average of all competing units was 75 lines of fine type in five minutes), eye comfort and personal preference of employees.

BASIC DATA

Number of outlets over 6,500.
Building ⅛ mile long, seven to thirteen stories high.
Ceiling height shown, 19 ft.
Unit spacing, 8 ft. 6 in. x 8 ft. 3 in.
Initial wattage, 200 per unit (as shown), 300 future.
Make of unit, Holophane "Filterlite."
Energy supplied by Hartford Electric Light Company.

Financial Practices of Few Endanger Utilities' Credit

By W. C. GILMAN
New York, N. Y.

AT THE risk of saying something quite obvious, let me observe that the ability to attract capital is dependent on the gradual establishment of a sound credit rating and the success or failure of almost all types of business is very closely connected with the winning and maintenance of credit. But credit is a timid creature. Let her once get a suspicion that your intentions are not strictly honorable and off she runs. Once gone you have a mighty job on your hands to get her to appear in your company again. This explains the danger involved in certain detrimental financial practices, which, in the opinion of the writer, may eventually cause a great deal of harm to the credit of the public utilities. These practices are:

1. *The use of the credit of operating companies to raise funds which are lent to the holding companies.*— This is usually unfortunate because the holding companies, with a few exceptions, are not entitled to credit ratings comparable with those of the best operating companies, and the loans are of dubious soundness, especially in a time such as the present. It may be that ordinary banking credit is not available because the banks are not satisfied with the risk.

Suppose, for example, that a holding company owns ten subsidiaries, all of equal size and with like capital structures, consisting of first mortgage bonds, preferred stock and common stock, the common being owned by the holding company. The holding company now wants funds for some outside purpose, or for the acquisition of new properties, but it lacks the credit to raise funds in its own name. The subsidiaries therefore sell $1,000,000 of bonds apiece to the public and the total of $10,000,000 is lent to the holding company, which places the money in something of a temporarily, at least, non-productive nature. Practically the only income which the holding company has is from the dividends on the common stock of the operating companies. Therefore, in order to pay interest on these advances, the holding company must either borrow more money or else use the dividends it receives, which in the final analysis means that it requires a portion of the dividends of the operating companies to pay interest on that portion of their bonds which were issued to make the loans to the parent company. If nothing else, this is an absurd situation and the actual examples of it vary from the foregoing only in degree.

In a recent case a New England operating company, with no apparent need of any cash for its own purposes, sold first mortgage bonds and loaned approximately the amount of the proceeds received to the holding company, whose credit never has been good. At a later date the holding company became financially involved and passed into the hands of receivers. The present status of this loan is unknown to the writer, but it must be obvious that such a practice is very disquieting to the holders of the operating company's first mortgage bonds and it would seem that the mortgage bondholders have every reason for questioning the ethics of such a transaction. In another case a large utility operating company has had outstanding for some time a loan to its holding company amounting to over $10,000,000, in this case nearly 20 per cent of its total plant and investment account. The total loss of this money through failure of the holding company would very nearly completely wipe out the company's surplus, which has been built up over a long period of years.

An important Middle Western operating company's recent balance sheet showed a large item "Due from holding company." The holding company in question earned its fixed charges on an "over-all basis" about one-and-one-third times in 1930, after taking credit for profits on sales of securities. Without this item the margin would have been less than one-and-a-quarter times. Surely the bills payable of the holding company hardly form an ideal repository for funds raised by the sale of sound operating company mortgage bonds and preferred stocks. It requires no vivid imagination to link some recent bond financing by the subsidiary with this loan. At the same time the operating company was engaged in selling large blocks of its preferred stock locally in the territory and also through security dealers in the New York market. Such examples as those mentioned above are by no means isolated cases, but rather indicate a rapidly growing tendency. Is it any wonder that security holders object to such practices?

Holding company's chief function

For a good many years utility holding company executives have stated that the principal function of the holding company was to assist the operating company in its financing. It seems rather odd now to find that in a great many cases the tables are turned and the operating company is financing the holding company. The present market for most holding company securities pretty clearly indicates that their ability to help finance the operating units has been somewhat over-rated. In cases where operating companies have built up more cash or liquid assets than they can profitably use in the normal conduct of their business it would be suggested that they strengthen and/or simplify their capital structures by redemption or purchase of underlying bonds or high

The writer of this article is an engineer employed by one of the country's most important financial institutions to investigate and analyze public utility properties. He expresses, therefore, the point of view of conservative institutional investors who have provided, in the aggregate, no small portion of the funds required to develop the electrical industry to its present proportions

dividend rate preferred stocks. But the utilities, by and large, can lay little claim to the exercise of great restraint in the declaration of dividends, and this tendency, coupled with the rapid growth of fixed capital, has made it an exceptional company indeed which has had superfluous cash lying around for any purpose.

If a loan of any importance is to be made by an operating to its holding company, the funds must be obtained by corporate financing by the operating company. Is there any one in the utility business who has the hardihood to stand forth and say that this is proper, or ethical, use of the operating company's credit, or that the security holders of the operating company (other than the common stock control) stand to benefit by such use, in proportion to the risk entailed?

2. *The declaration of large special dividends by operating companies,* the funds for which are not in hand, but are provided either by public financing or by a loan from the parent holding company. These dividends are dictated by the desire of the holding companies to bolster up their statements and perhaps in some cases so that they may continue dividends on their own generous capitalization. Of course, these special dividends are paid from corporate surplus, but unless the property account is stated at a reasonable value and unless adequate depreciation charges have been accrued, the corporate surplus may be fictitious in whole or in part.

A Western operating utility company, affiliated with one of the large holding company units, recently declared a special cash dividend, amounting to more than the total additions to surplus from earnings during the past six years, while during this same period accruals from earnings for renewals and replacements have not been overgenerous. Cash available for the payment of this special dividend was less than 20 per cent of the amount required; consequently we find that securities had to be issued in order to take care of the payment. This action resulted, of course, in a substantial reduction in the company's surplus, which is now less than it was four years ago, although the property account is now about 20 per cent larger. These highly conspicuous big dividends, entirely irrational in their relation to the time, may cause regulatory bodies to look into the genuineness of the surplus accounts from which they are nominally drawn. If property accounts have been subjected to a writing-up process to accord with reproduction costs which no longer exist, and if depreciation reserves leave much to be desired, the surplus account may look a bit pale and baggy under the eyes to a keen observer. Is it worth while to take the risk of throwing this whole question into the open, where state commissions and radical politicians can get their teeth into it, just so that the holding company can avoid taking a little of the bitter with the sweet, while other people are getting nothing but the bitter?

Big investors are critical

Institutional investors such as banks, insurance companies, foundations, trusts, educational institutions, etc., have been and now are important sources of funds which provide for public utility growth. The investment in the utility industry of United States legal reserve life insurance companies alone amounted to approximately $1,850,000,000 at the end of 1931, having increased about 1,400 per cent since 1906. That these life insurance companies have in the past had a good regard for utility securities is evidenced by the fact that in 1906 utility holdings amounted to 4.7 per cent of total investments, while at the end of 1931 utility holdings were nearly 10 per cent of total investments. These investments are predominantly in the actual operating units. Such investors, as mentioned above, have a vital interest in the welfare of the industry and in the maintenance of high credit standing by the various companies in which they have investments.

That at least one state public utility commission is alive to this situation is indicated by the following news item from ELECTRICAL WORLD December 12, 1931:

Bay State board seeks to control utility loans

Aroused to action by alleged unsound practices in extending loans to holding companies by operating organizations, the Massachusetts Department of Public Utilities has recommended to the incoming Legislature that jurisdiction be given the commission over loans by gas and electric companies to other corporations. The board points out that where loans to holding companies by the operating subsidiaries are restricted to that amount of cash which the operating company would otherwise distribute in dividends, the interests of consumers would not be adversely affected. "On the other hand," says the commission, "gas and electric companies are organized to manufacture and sell gas and electricity and not to engage in the business of lending money. We believe that the lending of money the way it has been done is beyond the corporate powers of the companies so lending and might properly be attacked by a stockholder.

"Where a holding company has acquired most of the stock of an operating company, it can be used as a device to force the sale of the stock not owned by the holding company to it, largely upon its own terms. By not declaring dividends and lending its profits to other utilities controlled by it, a powerful influence is brought to bear upon the owners of small amounts of the stock to sell their holdings. We believe that gas and electric companies should be prohibited from lending money, other than advances to their own employees, to a limited amount (say $1,000), unless approved by the department."

When operating company securities are sold to the public, the investor would seem to have a clear right to insist that the money proceeds from the sale of such securities be used by the company in the normal operation of its business, rather than lent to a holding company whose security he would not buy under any consideration. It would seem to be a proper function for the various state public utility commissions to see that this practice is discontinued.

If unsound financial policies, such as loaning money

to holding companies and the declaration of large special dividends, are continued it is certain that large investors will lose their enthusiasm for utility securities. It will probably cause them to look askance not only at the particular operating companies concerned, but at the offending management groups in their entirety. Anything that brings important groups into credit disfavor is injurious to the industry as a whole. It is unfortunate, but probably true, that if tendencies of this kind continue, the good citizens of the utility field, and there are many such, will suffer, at least in some degree, from the wabbly ethics of the few conspicuous offenders.

If I am not greatly mistaken, the higher type of utility executive will be found in general agreement with the opinions I have presented in this article. It is highly significant that one of these gentlemen, John E. Zimmermann, president of the United Gas Improvement Company, has spoken so plainly and so forcefully in his address to the Electrical Association of Philadelphia on December 10. Pertinent quotations follow:

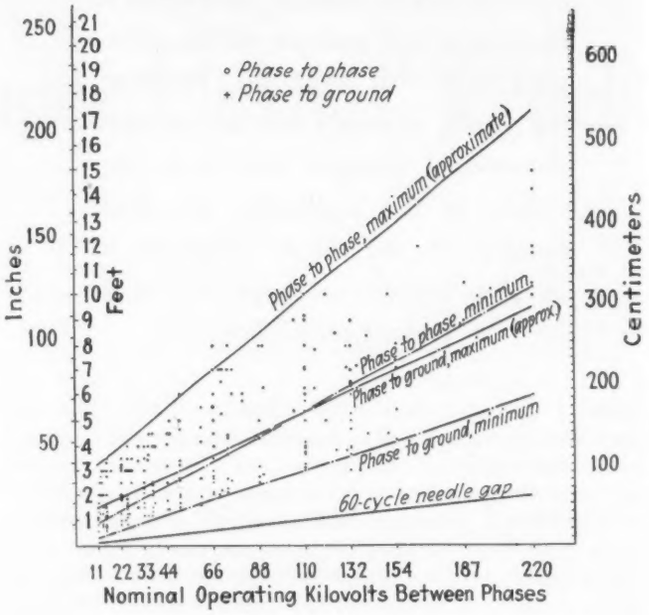
It is inevitable, in an industry which has expanded so rapidly and which has been called upon to solve so many new and difficult problems in finance, engineering and management, that mistakes have been made, unsound financial practices followed in some instances and unwise managerial policies put into effect in others. It does not seem to me, however, that anything constructive will be accomplished by destroying the industry for the sake of punishing a few.

Instead, therefore, of criticising the industry as a whole, the effective way to correct abuses which may exist is for the public to exercise a discriminating judgment between those companies and groups of companies whose properties are conservatively financed and managed in conformity with the best business standards of the day, and that relatively small number of companies or groups whose unsound financial or managerial policies and practices have brought discredit upon the industry as a whole.

Holding companies are a recognized instrument in present-day American finance, and they have played an essential part in the growth and development of the electrical industry. There can be no question whatsoever but that holding companies should not, and must not, be used to exploit their subsidiaries.

As has been previously pointed out, the criticism of the electrical industry is directed, not to the service of the operating companies to their customers, but to the relations of the entire industry with the public. In other words, it is the holding company, its financing and its contracts with its subsidiaries, its relations with other holding companies and electric groups, which is now the principal object of attack.

Bus Spacings and Ground Clearances



Wide variations in outdoor bus spacings and ground clearances are shown in the accompanying graph representing practices of 24 operating and consulting companies and reported in N.E.L.A. serial report No. 164. The minimum curves show a fairly well-established minimum for each operating voltage, but the maximum values show erratic practice.

Some of the factors that account for the variations are:

1. Impulse and lightning flashover clearances.
2. Elevation above sea level.
3. Length of spans, especially for open-type substations.
4. Shape and size of conducting parts of apparatus.
5. "Air-break" disconnecting switch spacing requirements.

▼ ▼ ▼

Floodlighting Installations as Load Builders

(Suggestions of General Electric Company)

	Average Kw. for One Installation	Estimated Burning Hours	Estimated Annual Kw.-Hr.
Gasoline filling stations	2	2,000	4,000
Office buildings	35	1,800	63,000
Banks	8	1,800	14,400
Monuments and memorials	11	1,800	19,800
Tennis courts	19	800	15,200
High school football fields	40	60	2,400
College football fields	52	60	3,120
Industrial football fields	47	60	2,820
Municipal football fields	51	200	10,200
Practice football fields	12	30	360
Stadiums	66	200	13,200
Industrial buildings	7	1,800	12,600
Libraries, hospitals and churches	3	1,800	5,400
Hotels	30	1,800	5,400
Schools and universities	6	150	825
State capitols	31	1,800	55,800

	Average Kw. for One Installation	Estimated Burning Hours	Estimated Annual Kw.-Hr.
Theaters	6	1,800	10,800
City halls and court houses	40	1,800	7,200
Substations	8	4,000	32,000
Utilities buildings	36	1,800	64,800
Racetracks	31	20	620
Playground—baseball	6	200	1,200
Ice skating	8	400	3,200
Trap shooting ranges	8	400	3,200
Baseball fields	196	140	27,440
Toboggan slides	3	200	600
Beaches	1	600	600
Swimming pools	11	600	6,600
Golf driving ranges	12	1,000	12,000
Fountains	27	1,000	27,000
Miscellaneous large areas	3	1,800	4,320
Interiors	2	400	800

Proof Testing of Cables Justified*

By CHARLES H. SMITH

Standardizing and Testing Department,
Edison Electric Illuminating Company of Boston

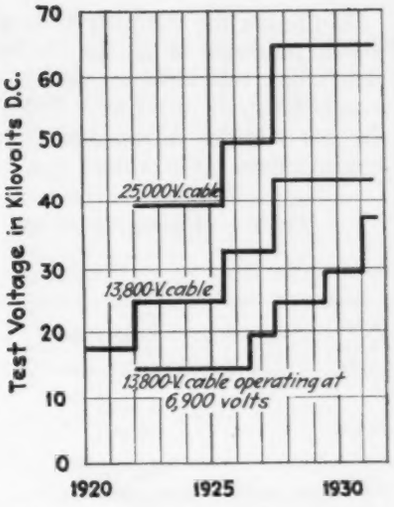


Fig. 1—Increasing test voltages on transmission cables

FOR many years there has been a difference of opinion in regard to the value of periodic high-voltage proof tests on transmission cables. While the value of an original acceptance test to check the condition of the cable and joints is not questioned, many engineers maintain that the periodic proof test may cause more damage to the cable than is justified. The experience of the Boston company in our opinion justifies proof testing, and it is noteworthy that from 1925 to 1930 inclusive our cable failures per 100 miles were but 11.9, against 13.5 for an average of 45 companies reporting to the N.E.L.A., clearly indicating that high-voltage proof tests have not increased the total failure rate.

The Boston company has been making high-voltage tests on cables for many years, using both alternating-current equipment and kenotron sets of portable design. The first kenotron outfit was built twelve years ago and developments progressed to a point where, in 1928, there became available a four-tube portable set with which tests can be made up to 200 kv. between conductors and up to 100 kv. from conductor to sheath. The four tubes can be connected in parallel to provide 1 amp. current capacity, though not at full voltage. Excellent success has been realized in reducing faults, and where this cannot be done high-voltage bridge measurements are made using potentials up to 30 kv. With a four tube kenotron any cable on the system can be tested at 100 kv. without running into the excessive kva. capacity needed in alternating current testing.

One of the advantages of proof testing is that it can be so timed that any faults produced can be repaired more economically from the labor standpoint than is usual with service failures. Another factor of weight is that a transmission line failure frequently causes a load transfer from one station to another less economical plant, causing under some conditions an additional generating expense of at least $100 an hour.

Classification of cables for testing

The Edison system of 207 cables has been divided into groups for testing as follows:

Group I (98 cables)—Lines feeding stations (or substations) supplied by over two lines. These lines can be spared for test and repairs at any time under normal operating conditions. Usually tests are made to allow repairs within 24 hours.

Group 1A (13 cables)—Lines feeding stations supplied by over two lines but where load or voltage conditions make all lines essential during heavy load periods.

Group II (66 cables)—Lines feeding stations supplied by two lines. These groups are tested at times when repairing and testing of the faulted line can be completed before the ensuing load period for that station.

Group III (13 cables)—Lines feeding stations supplied by but one line. Such lines can be removed from service only on permission of the electrical engineering department, as customers' service must not be interrupted. Testing must be done at an off-load period and safely ahead of the next load period.

Group IV (10 cables)—Lines which will cause a large load transfer from economical to uneconomical generation either at the time of test or during repairs. Removal can only be made at a safe period before the ensuing heavy load period. It is considered advisable to test immediately after 11 p.m. Saturday, and in case of failure to make repairs at once.

Group V (7 cables)—Lines which supply alternating-current network transformers. These lines can be taken only by permission of the electrical engineering department and are restricted as to test periods to safeguard ensuing load.

About half of these cables can be tested on weekdays and the routine was changed some time ago to facilitate holding closely to schedule by placing more lines at test disposal at other times than after 10 p.m. Saturdays than formerly obtained.

For testing during the week it is usually decided the day before testing what lines are to be proofed, the list being approved by the system load dispatcher and the maintenance of lines department. On the morning of the test a last-minute call is made to check conditions. For week-end schedules a list is made up about Wednesday. Load dispatching approval is obtained, with the co-operation of the maintenance organization. The work is so planned that at no time when tests are being made do test failures find those charged with repairing the fault unprepared. The result is a fault repaired at a minimum cost.

In eleven years of kenotron testing about 4,000 proof tests have been made, with about 400 failures; i.e., about one fault produced per ten tests. In reality the rate was higher in the earlier years of testing at lower voltages and has decreased under the present voltage schedule.

**From a paper before the underground systems committee, New England Division, N.E.L.A.*

At present the company tests 6,900-volt cables at six-month intervals at 38 kv., 13,000-volt cables at four-month intervals at 44 kv. and 25,000-volt cables at two-month intervals at 65 kv. Table I explains more fully the test voltages in use and their relation to cable test specifications. The values for 13,800-volt and 24,000-volt lines are calculated as being approximately 70 per cent of the maximum permissible test prescribed for installed cables during the guarantee period by the Association of Edison Illuminating Companies, 1930 edition of specifications. The value for 6,900-volt lines is approximately 65 per cent.

Table I—Voltage at Which Tests Are Made

Operating Voltage	Type of Cable	Tests* Between	Test Voltages Kilovolts A.C.	Test Voltages Kilovolts D.C.
6,900 } 13,800 }	Belted, class 2	C-C†	28	67
		C-S	16	38
13,800	Belted, class 1	C-C†	30	74
		C-S	18	44
	Shielded	C-S	18	44‡
24,000	Belted	C-C†	39†	95†
		C-S	26	66
	Shielded	C-S	26	66

* C-C test applied between conductors.

C-S test applied between conductor and sheath.

† Test to be omitted unless weakness is indicated between conductors.

‡ For the purpose of standardizing the test voltage for both types of 15-kv. cables, this value is approximately 77 per cent of maximum permissible test instead of the regular 70 per cent.

Class 1 cables include all 15,000 volt cables operating at 13,800 volts not included in class 2.

Class 2 cables include all 15,000-volt cables operating at 6,900 volts and certain old 15,000-volt cables operating at 13,800 volts which have indicated excessive test voltage due to low safety factor of joint insulation or failures between conductor splits during ground tests.

Table II—Percentage of Unknown Causes in Service and Test Faults

	Service Faults, Per Cent	Test Faults, Per Cent
1927	2.6	0
1928	4.3	2.6
1929	7.0	4.5
1930	5.9	2.2
Average	4.95	2.3

Test faults are easier to analyze than service faults because of the lesser amount of burning at the fault.

Table III—Analysis of Cable Failures for Four Years Favors Proof Testing

	1927		1928		1929		1930			
Inherent	27.1	24.2	14.55	20.2	7.40	19.3	18.1	12.25	17.9	21.5
Non-inherent	70.8	64.3	80.00	65.7	83.30	65.3	69.4	80.40	66.1	67.0
Unknown	2.1	11.5	5.45	14.1	9.30	15.4	12.5	7.35	16.0	11.5

Average Four Years

	E.E.I.Co.	N.E.L.A.	E.T.L. (2 Years)
Inherent	15.3	20.4	19.8
Non-inherent	78.6	65.3	68.2
Unknown	6.1	14.3	12.0

E.E.I.Co. figures are included in those of both N.E.L.A. and the electrical testing laboratories

The Boston company has far less "unknown" cable faults than the industry as a whole because the test failures are not so badly burned and make analysis easier.

The test schedule has removed the inherent faults, leaving a larger percentage of faults non-inherent.

Table IV—Failures per 100 Miles of Cable

	E.E.I.Co. Failure/100 Miles	N.E.L.A. All Companies No. Companies	N.E.L.A. All Companies Failure/100 Miles
1925	11.6	36	14.9
1926	11.9	41	16.6
1927	11.25	43	13.9
1928	13.3	46	12.75
1929	13.5	48	12.30
1930	10.0	56	10.55
Average	11.9		13.5

The Boston company has less failures per 100 miles than the industry as a whole.

Besides the proof tests, many hundred acceptance tests have been made on transmission and distribution cables, resulting in the removal of many faulty joints and sections prior to service outages.

In proof tests the voltage is held for five minutes and readings of leakage current are taken at intervals of 30, 45 and 60 seconds and two, three, four and five minutes. The tube life is obtained from the test sheet records. Tube life is increasing. Since 1925 the company has used 39 tubes in this work and now has on hand and in use a total of eleven tubes. The average life of all tubes to date is 55 hours; that of the 28 no longer in use, 45 hours, and of the tubes now in use, 81 hours to the time of writing. The maximum tube life obtained is 168 hours. A tube is used on proof tests about fifteen minutes per test, not allowing for the extra time required for fault reduction.

As soon as a line to be tested has been removed from service, properly tagged and turned over to the test man, the latter makes his own tests to make sure that the line is actually dead. He then attaches his test leads; i.e., a high-tension lead to one phase and a ground lead to the two other phases. Then making sure that all points of hazard are guarded (the test crew always consists of two men besides the tester, whose principal function after the set-up has been made is to guard the high-voltage lead), he gradually raises the voltage until the cable is at full test potential. After application of test voltage for the stated periods the switch is opened, automatic grounding switches discharge the cable and the regulator is run back to zero voltage. The two other phases are tested in turn and if no failure occurs the cable is turned over to the system operator and returned

Table V—Classification of Arc Feeder Faults

	+Cables 1929	+Cables 1930	—Cables 1929	—Cables 1930	Total 1929	Total 1930
Service faults	3	7	22	19	25	26
Low-tension test faults	5	15	31	33	36	48
High-voltage test faults	20	8	32	57	52	65
Short circuit test faults	*	10	*	17	*	27
	28	40	85	126	113	166

* Short-circuit tests were not made in 1929

Table VI—Results of High-Voltage Arc Feeder Tests

		1927	1928	1929	1930	Total
Total tests	+cable	69	137	98	59	363
	—cable	88	160	114	200	562
Total faults	+cable	28	34	19	9	90
	—cable	47	64	32	56	199
Total tests + and —		157	297	212	259	925
Total faults + and —		75	98	51	65	289
Total O.K. tests		82	199	161	194	636

Ratio of Faults in Positive and Negative Cables

	Ratio
All faults 1929	85/26 = 3.27/1
All faults 1930	126/40 = 3.16/1
Service faults 1929–30	41/10 = 4.1/1
High-voltage test faults four years	199/90 = 2.21/1

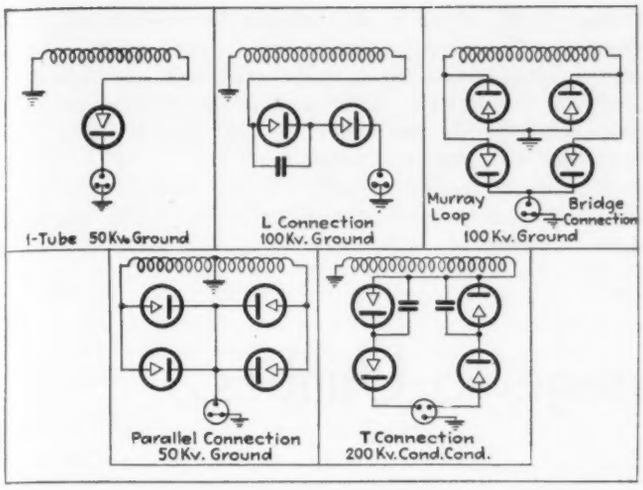
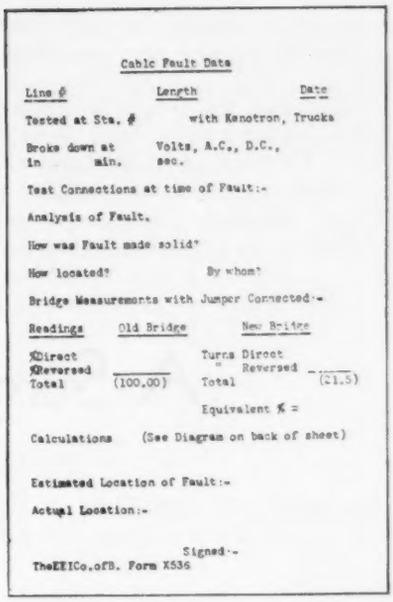


Fig. 2—Connection of kenotron tube for tests at various voltages


Cable Fault Data

Line # Length Date

Tested at Sta. # with Kenotron, Trucks

Broke down at Volts, A.C., D.C.,
in min, sec.

Test Connections at time of Fault:-

Analysis of Fault.

How was Fault made solid?

How located? By whom?

Bridge Measurements with Jumper Connected:-

Readings	Old Bridge	New Bridge
%Direct		Turns Direct
%Reversed		Reversed
Total	(100.00)	Total (21.5)

Equivalent % =

Calculations (See Diagram on back of sheet)

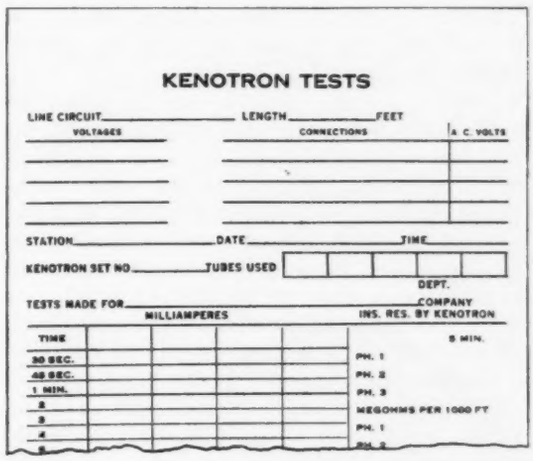
Estimated Location of Fault:-

Actual Location:-

Signed:-

The EEICo. of B. Form X536

Fig. 3 — Form used in Boston kenotron field tests


KENOTRON TESTS

LINE CIRCUIT_____ LENGTH_____FEET

VOLTAGES | CONNECTIONS | A. C. VOLTS

STATION_____DATE_____TIME_____

KENOTRON SET NO._____TUBES USED_____ DEPT.

TESTS MADE FOR_____COMPANY

MILLIAMPERES INS. RES. BY KENOTRON

TIME					5 MIN.
30 SEC.					PH. 1
45 SEC.					PH. 2
1 MIN.					PH. 3
2					MEGOHMS PER 1000 FT
3					PH. 1
4					PH. 2
5					

to service. Care is taken to avoid alarming the public by sudden noisy discharges.

The figures obtained for leakage current decrease during a normal test. Occasionally, however, in the course of a test the current will, after a short time, begin to increase. Breakdown will often occur before the end of the test period. In case it does not, the rising current, on paper cable at least, indicates an abnormal condition and that continued application of voltage would result in breakdown.

In some cases two phases show higher leakage currents than the third phase, indicating trouble between these two phases. Here the application of a higher test voltage between these two phases, using a T-connection with the third phase at mid-potential, will often produce a fault. Additional tests are made when this condition appears, and the maximum permissible test voltages are:

	Normal Test	Conductor-to-Conductor Test
6,900-volt cable	38 kv.	67 kv.
13,800-volt cable	44 kv.	74 kv.
25,000-volt cable	65 kv.	95 kv.

Where one phase is noticeably higher than the two others in leakage current, indicating conductor-sheath trouble, the voltage is raised in an attempt to produce a fault on that phase, after consultation with the maintenance forces.

If it appears that a fault will require some time in reducing, the test is continued at reduced voltage for a time, never to exceed the equivalent five-minute test at normal voltage. After the equivalent test is concluded the cable is grounded for 30 minutes before further application of voltage.

In the case of another company which has utilized the Edison company's alternating current testing trucks since 1910 in periodic proof tests of cables, service failures increased in 1927, a year when no proof tests were made. In 1928 the tests were resumed and test failures increased to nine, service failures falling off correspondingly. A similar experience was had in 1930. It is reasonable to assume that proof testing removed incipient faults, with consequent protection of service, and that the resumption of tests this year will produce similar good results.

Proof testing of cables has achieved the following:

1. It has produced no greater total of cable failures.
2. It has resulted in more accurate analysis of cable faults and made assigning the cause to its proper class much easier.
3. It has reduced the stresses on the transmission system by cutting down the number of service failures.
4. It has produced economies in repairs and generation.
5. It has enabled us to maintain those cables operating at below their rated voltage in such condition that at any time they can be used at that rated voltage.

Testing of arc circuit cables

The Boston company has for several years been making high-voltage tests on the arc circuit feeder cables, about 84 in number, originating in the L Street station at Boston. The cables are tested every morning with low voltage to determine whether any open circuits or grounds exist. In addition, a schedule of high-voltage testing at 10,000 volts alternating current is maintained. There has also been put into practice a schedule of tests made by grounding for five minutes first one side, then the other side of the circuits, in order to develop any incipient faults which can be developed by the voltage obtainable. These three tests have all resulted in cable faults. Table V gives the fault figures for 1929 and 1930.

Experience has indicated that negative cables require more tests then positive cables (see Tables V and VI).

Because of the wide difference in faults, the negative

cables are scheduled for test three times a year, while the positive cables are scheduled for but one test a year.

The reason for this wide difference is that these arc circuit feeder cables have been in service for many years. They are operated from brush arc machines and are, therefore, half of positive polarity and half of negative polarity. They are so old and congested that in working on one cable it is easy to cause a break in another. The result is that sheath breaks are not uncommon. The negative conductor attracts water, which enters through the break and penetrates and deteriorates the insulation. The positive conductor, on the other hand, repels the water, so that any tendency of the water to enter the cable is overcome while it is alive, at least, by the osmotic effect. This is reflected, we believe, in the greater number of faults on the negative cables.

▼ ▼ ▼

A Surgeon's Message to Utilities

By SAMUEL R. BENEDICT
Chief Surgeon Alabama Power Company

Electrocardiographs show that regular contractions of the heart persist as long as 30 minutes after apparent death from electrocution, drowning and asphyxiation.

To save the thousands of lives that will be lost through failure to recognize this fact and promptly apply suitable artificial respiration, as well as to prove to the public that utilities are not soulless, Dr. Benedict urges that they apprise the public of the special training of their employees in artificial respiration and invite every one to call the company immediately when need of such help exists.

SO OFTEN in the past the question has been asked me, not only by laymen, but also by physicians, whether the heart beats after a person is electrocuted, drowned or asphyxiated, or, in other words, whether the heart beats after the ordinary tests for life fail. My answer would be "Yes" in physiological* death and "No" in pathological death.

In a paper by Dr. von Hoesslin read before a meeting of the Berlin Medical Society and published in the *Neueste Nachrichten*, Leipzig, it is shown that by the use of the electrocardiograph, an instrument which is probably one of the most delicate used by the medical profession registering the slightest movement of the heart muscles, regular contractions of the heart continue as long as 30 minutes after physiological death. The electrocardiograph also shows that these contractions are strongest immediately following physiological death, and as time goes on they gradually get weaker and weaker until the heart ceases entirely to function, except for occasional contractions which occur at irregular intervals.

Let me quote from Dr. von Hoesslin's paper:

> Occasionally prior to the final cessation of beats, there supervenes an interval of increased susceptibility to stimulation, or "irritability."
>
> This causes for a brief interval a swifter beat rate until in the end complete stoppage ensues.
>
> Yet even then all life is not extinguished in the heart. Its separate components may singly for days effect contractions and respond to stimuli.

Therefore, you can easily realize the great importance of early and concerted action so far as the administration of artificial respiration is concerned. And you can also realize why it is that at times even after hours of artificial respiration a person who has been electrocuted or drowned is resuscitated.

It is only reasonable to suppose that a heart muscle which for years has been pumping at the rate of 60, 70, or 80 times a minute should continue to contract even after consciousness and respiration have ceased and all of the ordinary signs of death appear, with the exception of *rigor mortis*.

I am thoroughly convinced that in certain cases following trauma or injury, such as being thrown from an automobile and from all appearances killed, a person can by proper methods of artificial respiration be restored to life. Here we have in many instances, I am sure, what we have already referred to as physiological death, and with artificial respiration some of these cases can be brought back to life. Therefore, I would say from the standpoint of physiological death we might include those persons who are electrocuted, drowned or asphyxiated from gases and in a certain proportion of cases those who have been rendered unconscious and apparently dead from trauma. I am not only convinced that thousands of people have died for the want of artificial respiration following electrocution, drowning or asphyxiation, but also that large numbers have died for want of artificial respiration following injuries which rendered them apparently dead, when in fact only physiological death existed.

I feel that so far as the electric industry is concerned, and especially the public utility, the education of employees in the proper method of artificial respiration is essential. However, I do not believe that this is going far enough, as the general public should be advised through newspapers and otherwise that the employees of the public utility are well trained to render this service in cases of electrocution, asphyxiation, drowning and in

**Physiological death is that death which results from an accident such as electrocution, drowning, asphyxiation or being injured otherwise so that respiration ceases and the heart stops functioning normally. Physioligical death occurs in an otherwise perfectly healthy person as the result of an accident, while pathological death is that death which occurs as the result of disease such as tuberculosis, pneumonia, cancer and conditions of this character.*

those cases in which trauma has produced physiological death.

The importance and the necessity of the above action were impressed upon me recently by an accident that occurred while I was on my vacation. A seven-year-old boy was drowned, in three or four minutes his body was taken from the water. Within four blocks of the point where he was drowned well-trained men sat in the local office of the electric power company, and yet they knew nothing at all about this accident until hours afterward. Instead of these men, who were well trained, being called, an ambulance was summoned, a mechanical machine was used with no results. I am convinced that had the inhabitants of this small town been advised from time to time through the columns of the newspapers and otherwise that men who were competent to give artificial respiration properly were at their service, these men would have been called and their efforts would have been successful.

This is just one case in point. There are thousands of instances of this kind occurring every year in the cities and rural communities where electric companies operate. What greater service can a public utility render the community in which it operates than to restore the life of its people who are drowned, electrocuted, gassed, etc. A service of this kind rendered by the employees of a public utility would be of great benefit from a public relation standpoint, outside of the question of saving a human life, and would do a great deal toward placing a public utility in the good graces of the people that it serves. The mere fact that we have saved a life is reward sufficient, but in addition to this the public utility receives complimentary recognition for the service rendered.

Remember that the heart beats after physiological death, and while the medical man with his ordinary methods of testing cannot determine this positively, nevertheless that wonderful instrument, the electrocardiograph, has shown over and over again that the heart continues to beat for a while after physiological death. It is only a question of whether respiration can be started and the heart given a boost sufficient to make it pick up its normal life-giving contractions, thus supplying blood to the different parts of the body and especially to the brain, so that the function of the brain, which has temporarily ceased, can again be brought into play and life restored.

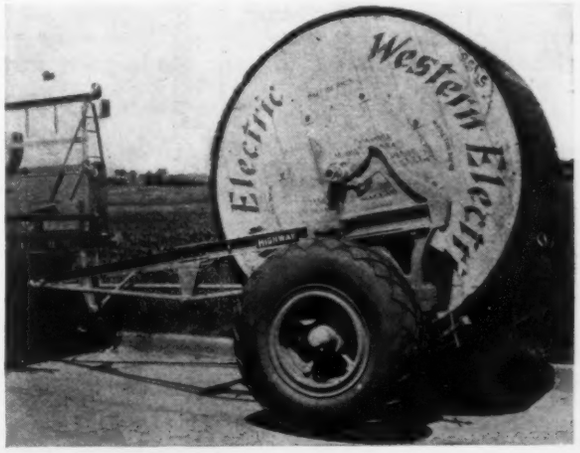
The public utility of today cannot neglect the instruction of its employees in the modern method of artificial respiration and I feel that it cannot afford to neglect the question of advising the public, which it serves, of this fact, for even though it might not create in the general public an attitude of appreciation, you can never tell when a prompt call to the local office may save some one's life in a case wherein a distinct liability would have existed had not this life been restored. Too much work cannot be done in instructing not only the employees of all large electric utility corporations, but also the general public in the modern method of artificial respiration. A life saved in itself makes this very much worth while.

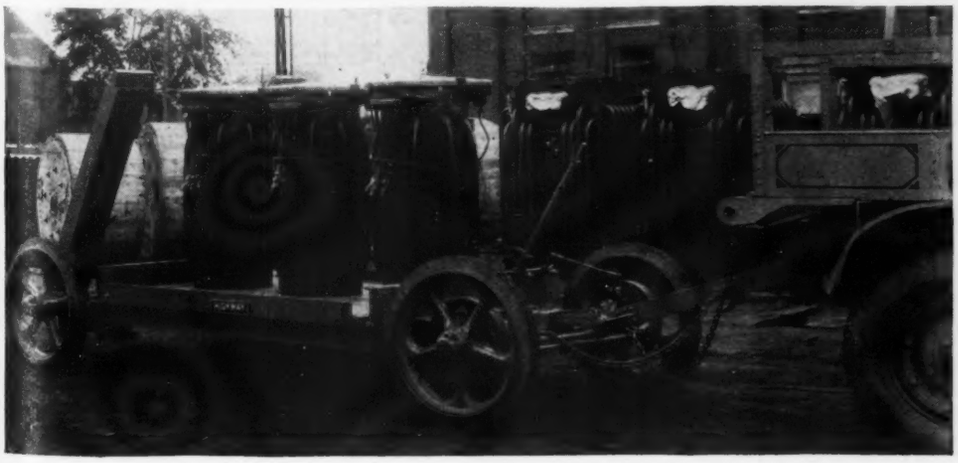
▼

Trailers Meeting Heavier Demands

From simple trailers, designed by wagon builders and utilizing ordinary wooden wheels and frames for pole handling and light transport of central-station distribution system supplies, equipment builders have lately developed more specialized towing apparatus in which the best features of heavy automotive practice are applied to speed up field work.

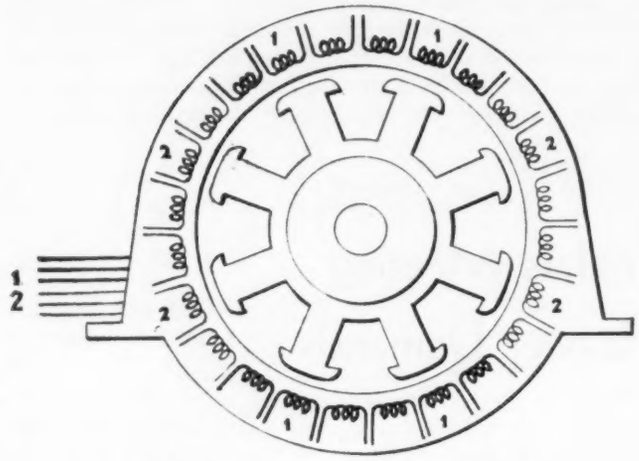
Rapid loading, unloading and transport of cable reels, transformers, oil circuit breakers and other equipment are expedited by trailer designs in which the use of balloon and solid rubber tires, structural steel frames,

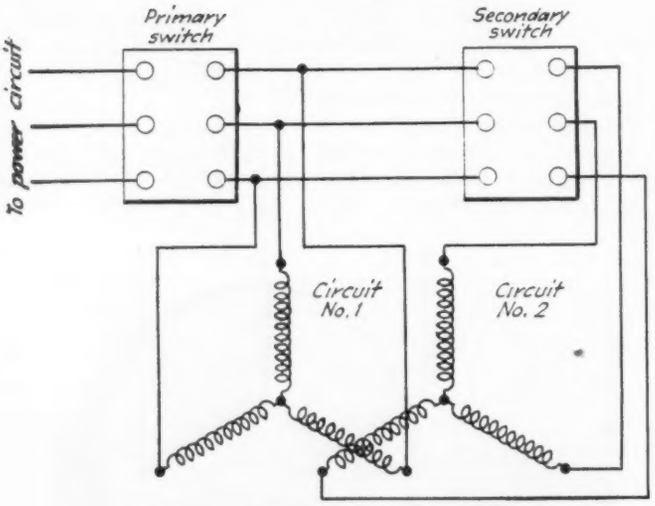




cast wheels, low-hung bodies and adjustable couplings are features. Cable can be paid out from the trailer when uncoupled from the truck, reducing handling; low centers of gravity facilitate safe operation at road speeds and protect crews against overturns, and reel wear is prevented by cradling. Only one man besides the driver is required to unload the reel and man-hours have been cut 50 per cent on many jobs by modernized trailing.

Part-Winding Starting for Synchronous





How part-winding starting works

Here is a schematic diagram of an eight-pole motor with two parallel stator circuits. In part-winding starting one of the parallel circuits is connected to the line at full voltage, as shown by the heavy lines. At two-thirds or three-quarters speed, depending upon the local starting current requirement, the second parallel circuit is connected to the line at full voltage and the entire stator winding is energized. Where more than two starting steps are required, additional parallel paths may be employed in the motor. The control for part-winding starting consists of a primary three-pole, single-throw line switch which opens both circuits in event of overload or short circuit, a secondary three-pole, single-throw switch for connection of the second parallel circuit, a frequency-responsive transfer relay to actuate the secondary switch, a field contactor and its operating frequency synchronizing relay.

Part-winding starting reduces control circuit complexity

As synchronous motor circuits go, this is a simple one, although it incorporates both push button control and complete relay protection.

New starting method utilizes two or more parallel circuits in the motor stator winding, connected successively to the line to give increment starting.

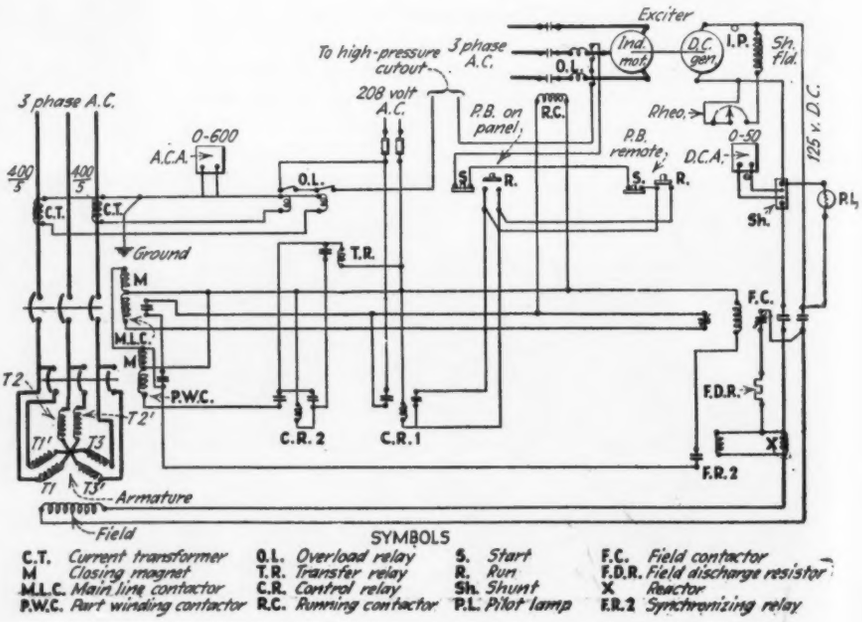
Particularly applicable to synchronous motors on secondary networks driving refrigerating compressors for cooling systems.

By C. R. ZIMMERSCHIED

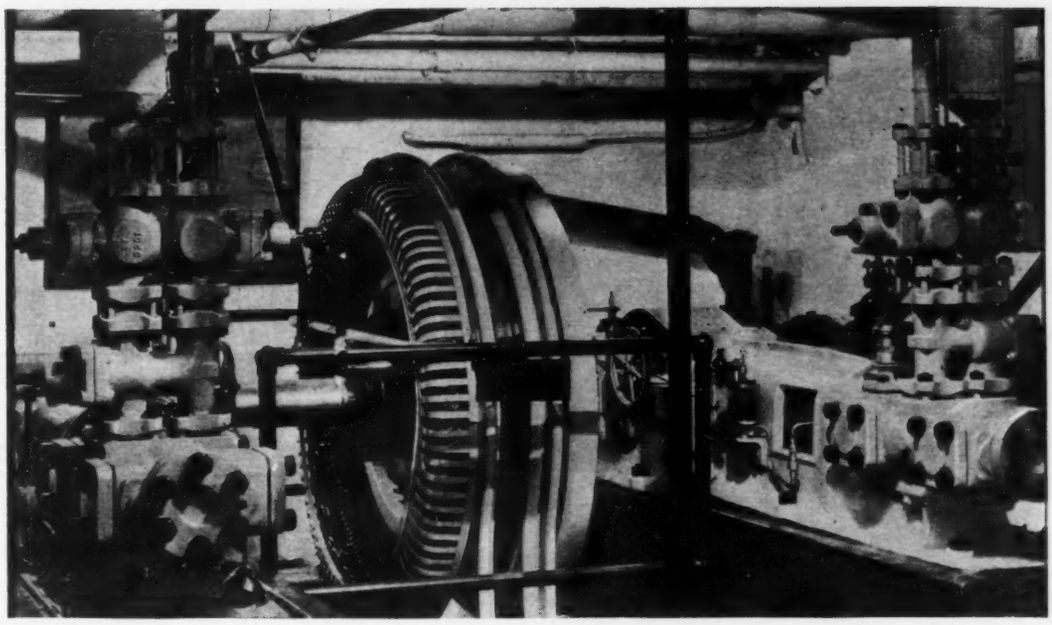
Engineer Electric Machinery Manufacturing Company

METROPOLITAN theaters using synchronous-motor-driven carbon-dioxide compressors for air conditioning are often located in congested districts where the power companies cannot tolerate the use of equipments which will in any way disturb lighting customers receiving power from the same network system. Because of the secondary voltage levels at which these networks operate, line current per unit of motor horsepower in starting is comparatively high. Thus it is necessary, in order to avoid voltage drops which would cause objectionable flickering of lights, to start large motors on the line by increments.

Definite limitations are placed in starting large motors, either upon the total current which may be drawn, or the amount of current which may be drawn per unit of



Motors



Served from a secondary network

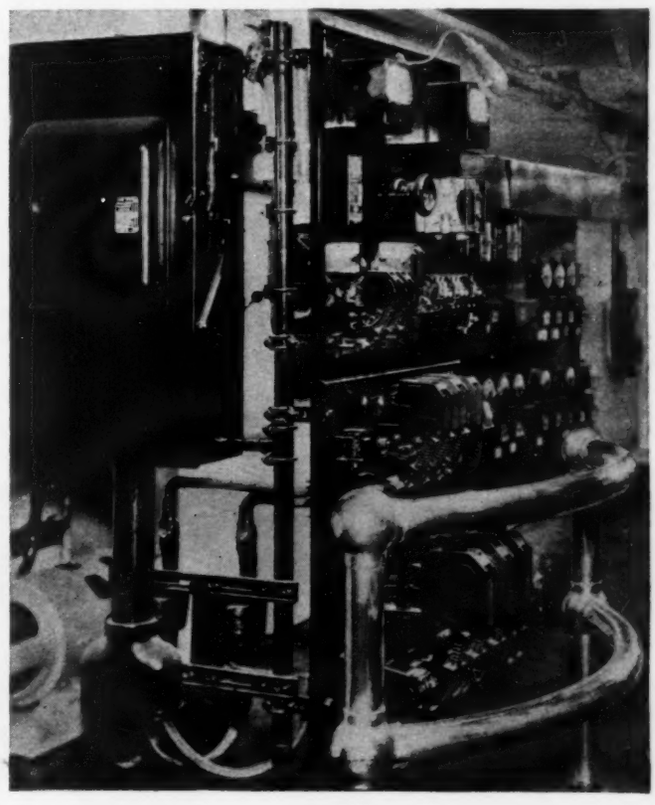
In the R-K-O Theater at Providence, R. I., this 175-hp., 164-r.p.m., 208-volt synchronous motor drives a carbon-dioxide compressor for the air-conditioning system and because of part-winding starting causes no perceptible voltage disturbance on the network.

time, or both. These limitations are designed to limit to a tolerable value the voltage drop when the motor is first connected to the line at reduced current, and to permit the voltage regulators to restore normal voltage before the motor is fully connected to the line. Inasmuch as a slight drop in voltage results in a comparatively large and noticeable decrease in the candlepower of lights it will be seen that current inrush limitations must be quite strict to avoid disturbance to lighting loads using the same source of supply as large motors.

Synchronous motors for driving carbon-dioxide compressors ordinarily draw from the line two and a half to three times their normal full-load current, when started on full voltage. Because of this high inrush current full-voltage starting is of course not allowable, and a starter must be used which will start the motor in suitable low current steps. In the past synchronous motors on low-voltage network systems have been almost always started by means of an increment step control in which the steps are obtained by including a resistance or a reactance in series with the motor while standing and short circuiting it out of the circuit as the motor attained synchronous speed. The usual auto-transformer or compensator method of starting has not ordinarily been allowed on network systems because the motor must be disconnected from the line when transferring from reduced to full voltage, causing a considerable shock to the power supply system.

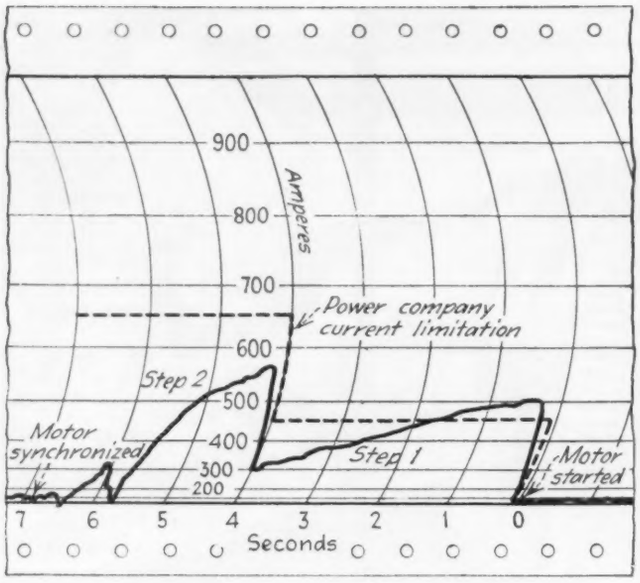
In the part-winding, increment-starting method the motor stator is divided into two or more parallel circuits; one of the circuits is connected to the full line voltage at standstill, the other or others connected to the line later during the starting period. This starting method is based on the discovery that when only one of two parallel, properly distributed stator circuits is connected to full line voltage the impedance of this winding is considerably greater than that of the two windings in parallel, resulting in lower starting current and torque. Since most low-voltage synchronous motors are normally designed and built with two or more parallel circuits per phase, this construction, which is used in part-winding starting, does not involve any additional complication in motor construction, with the exception, of course, of bringing out three additional leads for each step of current reduction.

The application of part-winding, increment control will vary with local power company requirements. When the power company has a large reserve power



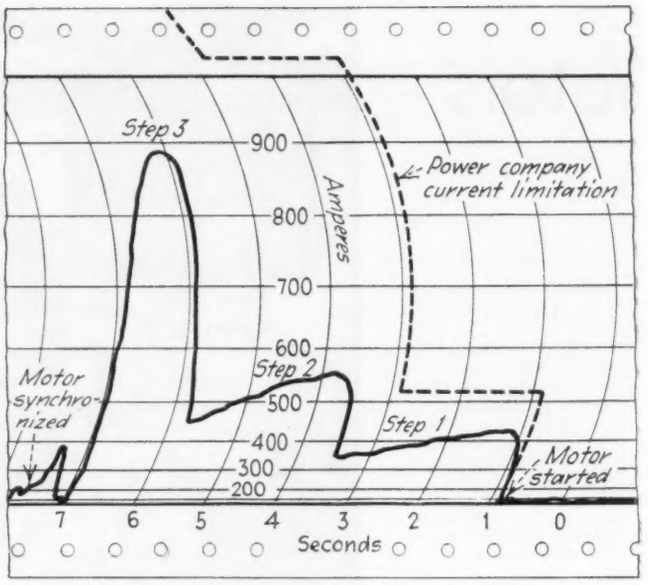
Starting equipment is compact

Note the absence of transformers and compensators from the equipment assembly for part-winding starting, which requires only current contact means.



Comparison with current limitations of utility

In the Providence R-K-O Theater a 175-hp., 164-r.p.m. synchronous motor drives a Brunswick-Kroeschell two-cylinder, double-acting, horizontal, single-stage, carbon-dioxide compressor with two-step, part-winding, increment-starting equipment. Power is furnished by the Narragansett Electric Light Company on a 208-volt, three-phase, 60-cycle network system. The normal full-load running current of this motor is 400 amp. The power company requires that the current on the initial starting step shall not exceed 450 amp. and that the current on the second step applied after the motor has started to accelerate must not make a total to exceed 650 amp. with 208 volts potential. The current values on this installation were satisfactory to the utility, although, as shown by the record, the first step exceeded the stated limit.



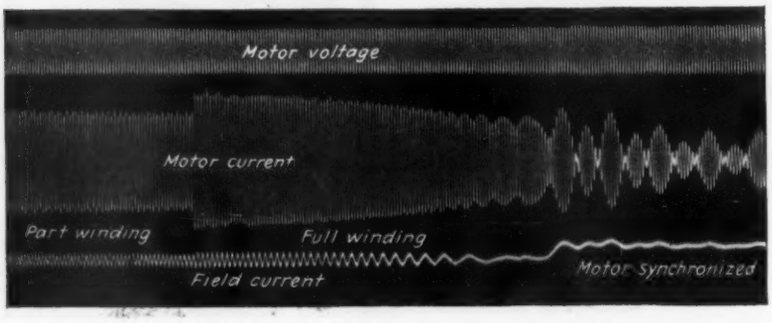
Starting in three steps

In the Fox State Theater, Jersey City, N. J., the increment starter is provided with three steps instead of two. The installation consists of a 225-hp., 360-r.p.m. synchronous motor with three-step, part-winding control driving a York two-cylinder, vertical, single-acting carbon-dioxide compressor. Power is supplied by the Public Service Company of New Jersey from its 200-volt, three-phase, 60-cycle network system. The starting current was limited to 520 amp. per step, allowing an interval of two seconds between steps. No maximum starting current was stipulated. The starting equipment is similar to the two-step installations except that an additional contactor is provided for the third step, together with the proper field-responsive relay to actuate the contactor at proper speed. The field test on this equipment showed that 420 amp. was drawn from the line with the first stator winding in the circuit. The motor had sufficient starting torque to start and accelerate to about 50 per cent speed in two seconds, at which time the current had decreased to 350 amp. When the second stator winding was energized the current went up to a total of 550 amp. and decreased to 450 amp. before the third step was applied, which resulted in a total of 900 amp. The total starting period was approximately six seconds.

capacity only the current per increment and the time interval between increments are limited and it is necessary only to provide enough increments to start and accelerate the motor to synchronous speed. However, if the power company does not have such a reserve capacity a limit is placed on the total starting current. It is obvious that where a limit is placed on the maximum current which can be drawn by the motor, it must be so designed that the motor will actually start and begin to accelerate the compressor before additional increments of current are added. Here the part-winding starting method shows advantage over the resistance and reactance types of starting in providing higher values of torque per unit of starting current.

The controls provided in the part-winding starting method are equipped with field-frequency responsive synchronizing relays to apply excitation to the motor field at the proper speed. This is particularly important on compressor drives using increment starting as it insures proper synchronizing regardless of the time taken for acceleration. The applications of the second and third steps of the stator winding are also usually controlled by field-frequency responsive transfer relays. A time relay is sometimes employed to energize additional sections of the stator winding where very low increments of current are required.

The advantages of this form of synchronous motor starting are: Simplicity, because of elimination of devices for reducing voltage, such as resistances, auto-transformers or reactors, since the full voltage is applied directly to the motor winding, and elimination of extra contact points over auto-transformer starting; less maintenance; less surge and line disturbance at starting and



Smooth starting by part-winding method

The method affords smooth transition from reduced current through the starting period to full kva. with the motor on the line; that is, when the second winding of the motor is added there is no displacement in phase relationship of the current, nor is there any current surge such as occurs when the circuit is opened during the period of starting with an auto-transformer.

transfer, because circuit to line is not opened; flexibility of arranging torque increments; foolproof against changes made in the field, such as the insertion of a copper bar in the place of a burned-out resistance or reactor, and less likely to give trouble because of its simplicity.

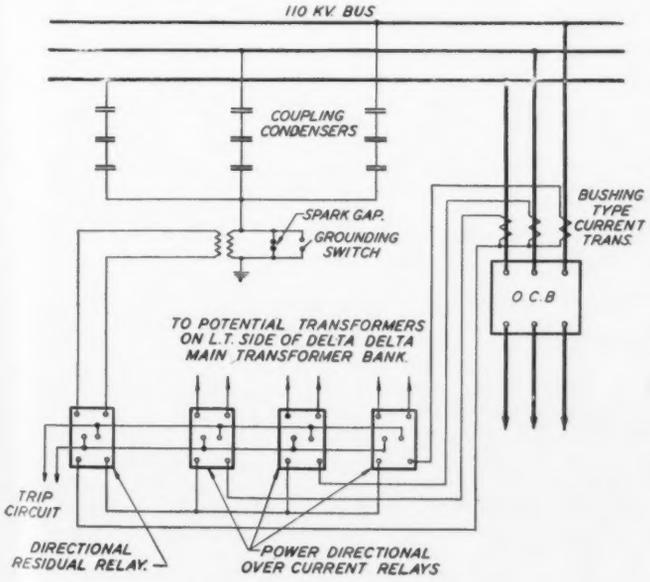
▼

Coupling Condensers Provide Directional Relay Current

By A. V. JOSLIN

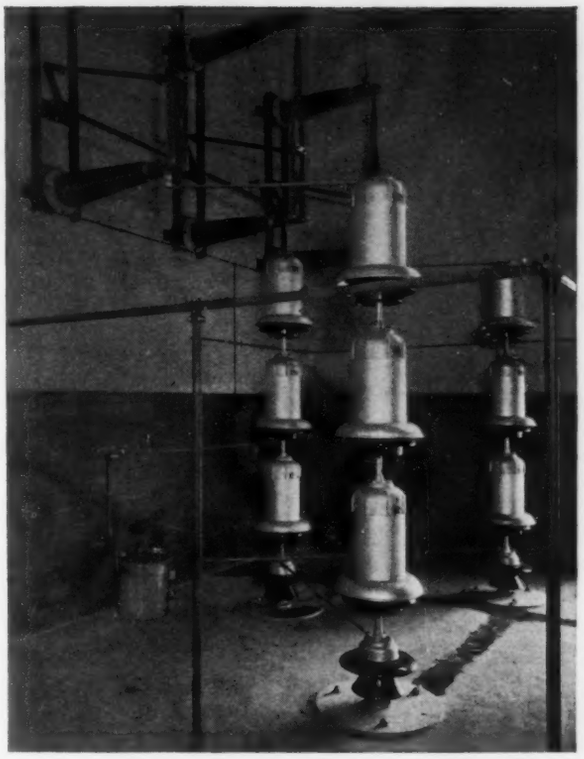
Assistant Engineer Pacific Gas & Electric Company, San Francisco, Calif.

Difficulty of obtaining directional current of proper magnitude and phase angle for the satisfactory operation of single-element directional residual relays has been overcome by the Pacific Gas & Electric Company by replacing the single-element with the two-element type. Residual current only, obtained from the line current transformers, is used in one element to determine timing. The other element provides the directional feature and is operated by both the residual and directional currents. With the single-element relay formerly used considerable difficulty was experienced with proper timing and sequence of operation. This was due in some cases to lack of sufficient directional current obtained from main bank neutrals or from special small 110/5-volt, star-delta banks operating from the 110-kv. potential bus, and in other cases to phase displacements ranging up to 40 deg. between directional and residual currents. With the two-element relay directional current may be obtained from any proper source as long as its minimum value is sufficient to close the directional contacts within a few cycles.



Method of obtaining directional current for residual relays

110-kv. coupling condensers and a single potential transformer are used.



110-kv. coupling condensers provide directional current for residual relays

In a recent installation it was desired to use directional residual relays, but there was no available source of directional current. The main 110-kv. banks are connected delta-delta and there were no 110-kv. potential transformers. Moreover, there was no satisfactory location available for a potential transformer bank.

High-voltage coupling condensers were therefore decided upon for the primary source of the directional current. Directional current was required for residual relays only, owing to the fact that the directional overcurrent phase relays obtained their directional current from potential transformers on the low-tension bus. Because of this the usual installation of three transformers connected to the three condenser stacks seemed unduly complicated for the simple duty required.

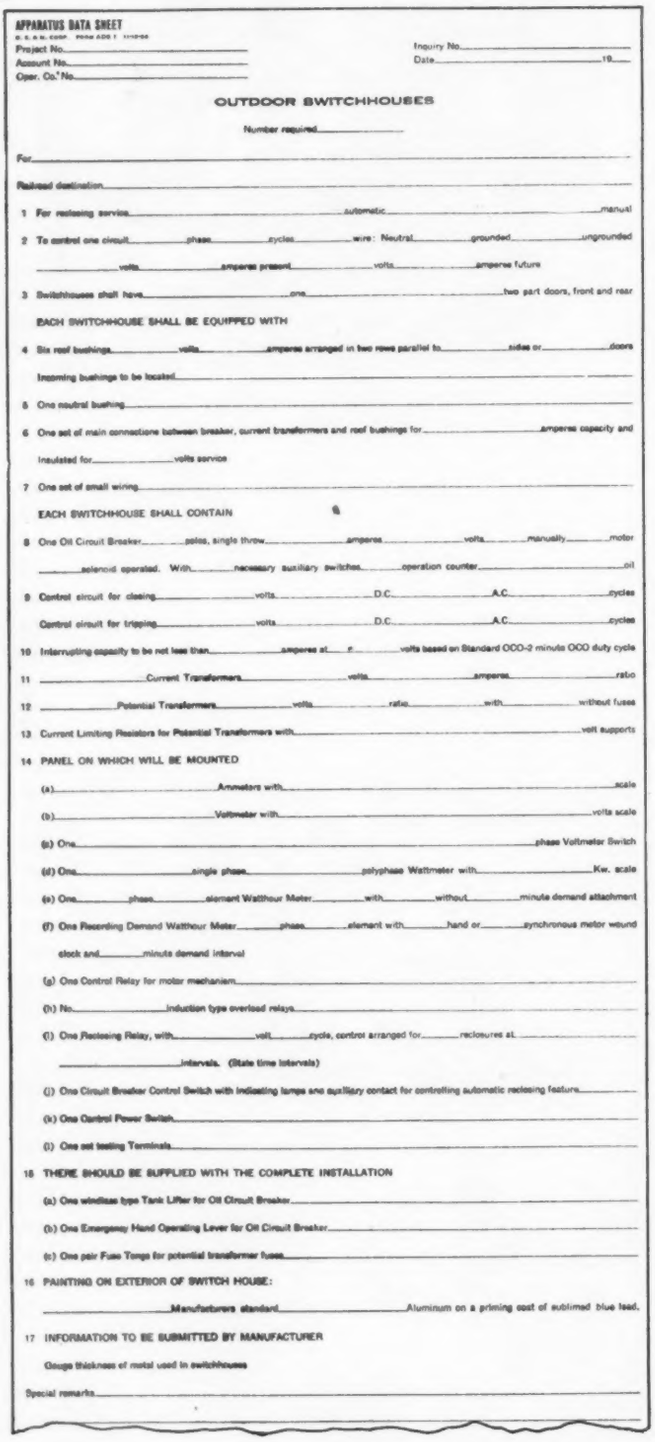
Engineers of the Ohio Brass Company suggested connecting a single potential transformer between the neutral of the condenser stacks and ground, as shown in the accompanying diagram, to provide the directional current required. Such an installation was made. Current from this single transformer leads the line-to-ground voltage by approximately 90 deg. Fault current to ground usually lags behind the voltage by 60 to 80 deg., and by reversing the directional current obtained from the single potential transformer the phase difference between the directional and residual currents supplying the relay is reduced to a value of 10 to 30 deg. Characteristics of the relays is such that this small difference does not materially affect maximum disk torque for the duration of a ground fault.

Tests simulating fault and normal operating conditions showed operation as anticipated. The low cost and simplicity of such an installation recommend it as an excellent method of obtaining directional current for two-element residual relays.

Engineering Data Sheets Simplify Purchasing

By RUSSELL C. WENZ

Assistant Purchasing Engineer
Byllesby Engineering & Management Corporation, Chicago, Ill.



APPARATUS DATA SHEET

Project No. _____ Inquiry No. _____
Account No. _____ Date _____ 19__
Oper. Co.' No. _____

OUTDOOR SWITCHHOUSES

Number required _____

For _____

Railroad destination _____

1 For reclosing service _____ automatic _____ manual

2 To control one circuit _____ phase _____ cycles _____ wire: Neutral _____ grounded _____ ungrounded

_____ volts _____ amperes present _____ volts _____ amperes future

3 Switchhouses shall have _____ one _____ two part doors, front and rear

EACH SWITCHHOUSE SHALL BE EQUIPPED WITH

4 Six roof bushings _____ volts _____ amperes arranged in two rows parallel to _____ sides or _____ doors

Incoming bushings to be located _____

5 One neutral bushing _____

6 One set of main connections between breaker, current transformers and roof bushings for _____ amperes capacity and

Insulated for _____ volts service

7 One set of small wiring _____

EACH SWITCHHOUSE SHALL CONTAIN

8 One Oil Circuit Breaker _____ poles, single throw _____ amperes _____ volts _____ manually _____ motor

_____ solenoid operated. With _____ necessary auxiliary switches _____ operation counter _____ oil

9 Control circuit for closing _____ volts _____ D.C. _____ A.C. _____ cycles

Control circuit for tripping _____ volts _____ D.C. _____ A.C. _____ cycles

10 Interrupting capacity to be not less than _____ amperes at _____ r _____ volts based on Standard OCO-2 minute OCO duty cycle

11 _____ Current Transformers _____ volts _____ amperes _____ ratio

12 _____ Potential Transformers _____ volts _____ ratio _____ with _____ without fuses

13 Current Limiting Resistors for Potential Transformers with _____ volt supports

14 PANEL ON WHICH WILL BE MOUNTED

(a) _____ Ammeters with _____ scale

(b) _____ Voltmeter with _____ volts scale

(c) One _____ phase Voltmeter Switch

(d) One _____ single phase _____ polyphase Wattmeter with _____ Kw. scale

(e) One _____ phase _____ element Watthour Meter _____ with _____ without _____ minute demand attachment

(f) One Recording Demand Watthour Meter _____ phase _____ element with _____ hand or _____ synchronous motor wound

clock and _____ minute demand interval

(g) One Control Relay for motor mechanism _____

(h) No. _____ induction type overload relays _____

(i) One Reclosing Relay, with _____ volt _____ cycle, control arranged for _____ reclosures at _____

_____ intervals. (State time intervals)

(j) One Circuit Breaker Control Switch with indicating lamps and auxiliary contact for controlling automatic reclosing feature _____

(k) One Control Power Switch _____

(l) One set testing Terminals _____

16 THERE SHOULD BE SUPPLIED WITH THE COMPLETE INSTALLATION

(a) One windlass type Tank Lifter for Oil Circuit Breaker _____

(b) One Emergency Hand Operating Lever for Oil Circuit Breaker _____

(c) One pair Fuse Tongs for potential transformer fuses _____

16 PAINTING ON EXTERIOR OF SWITCH HOUSE:

_____ Manufacturers standard _____ Aluminum on a priming coat of sublimed blue lead.

17 INFORMATION TO BE SUBMITTED BY MANUFACTURER

Gauge thickness of metal used in switchhouses

Special remarks _____

IN ORDER to maintain fair competition in the purchase of electrical equipment and apparatus complete and uniform information must be given to all bidders. Specifications must be entirely clear, for if incomplete one or more bidders might make assumptions regarding the missing data covering the item required and base quotations accordingly. In most cases this practice results in the bid being omitted from the list of approved quotations the engineer returns to the purchasing department, and guesswork by bidders narrows competition. In order to eliminate guessing or wasting time in obtaining missing information and to aid in clearing up certain complexities in the minds of engineers and operators several "apparatus data sheets" in what will be finally a complete series have been developed by the Byllesby Engineering & Management Corporation covering important items of equipment and cables which are purchased regularly.

In requisitioning any item for purchase the engineer may encounter difficulty in remembering all the points necessary for the bidder to consider in submitting a complete quotation, and there may be uncertainty in his mind regarding just what information the manufacturer should have. It is the function of the apparatus data sheet to act as a definite tie between the engineering

ADVANTAGES OF APPARATUS DATA SHEETS

1. **To the Engineer:**
   (a) Avoids omissions and repetitions of error.
   (b) Saves time in preparation of specifications.
   (c) Saves time in elimination of unnecessary conferences with representatives of various bidders.
   (d) Saves time in analyses of bids.
   (e) Simplifies correspondence and telegrams in reference to bid by using line numbers instead of long descriptions of each item.

2. **To the Purchasing Agent:**
   (a) Results in complete quotations.
   (b) Ease in interpreting specifications.
   (c) Elimination of unnecessary correspondence with the bidders.
   (d) Makes it possible for central purchasing office to place orders promptly for subsidiaries or remote engineering offices.
   (e) Allows fair competition.
   (f) Eliminates individual style of writing specifications.

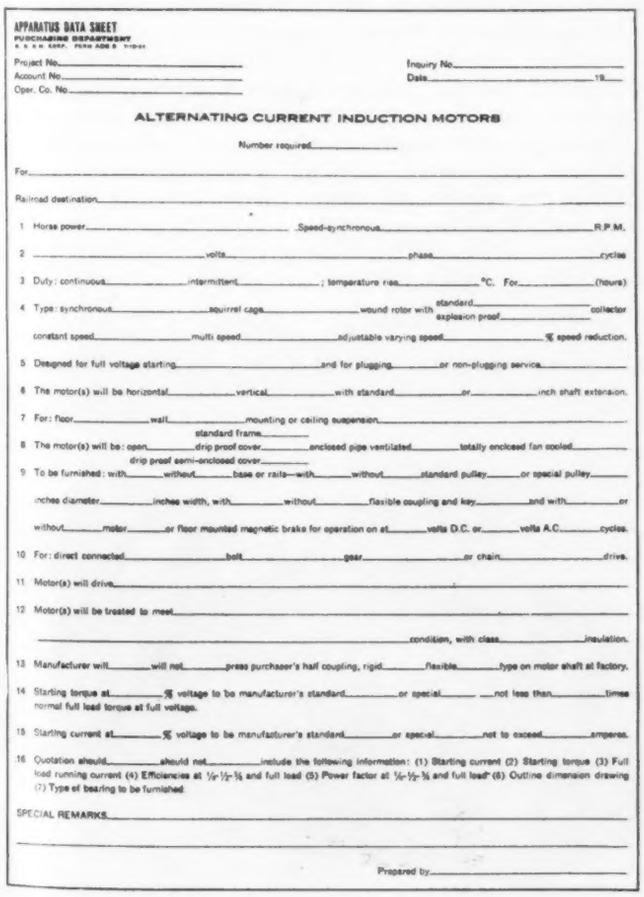
3. **To the Bidder:**
   (a) Eliminates checking with customer for missing information in specifications.
   (b) Eliminates unnecessary correspondence with factory engineers.
   (c) Allows all bidders to quote on equal basis.
   (d) Reduces time required to prepare quotation.

and purchasing department and to clear from the engineer's mind any uncertainty in relation to what or how much information is necessary in any requisition.

It seems quite reasonable that an engineer could take a form covering the equipment desired and fill in all of the blank places on it knowing that if all the questions on the form were answered it would be unnecessary to make a serious check on other specifications to be sure that complete information had been given to the manufacturer. An engineer who has been engaged in specification writing for over ten years voluntarily stated it had taken him only ten minutes to fill out an apparatus data form covering an ordinary bank of power transformers, whereas previously it had taken him more than an hour to write this specification.

If bidders receive an incomplete specification it is their practice, where possible, to call on the engineer originating the specification to obtain information which was not given originally. In the case where the central purchasing office sends out this information for a distant property it is sometimes necessary to get in touch with a branch office, which in turn sends a man to call on the originating engineer. This procedure not only delays the quotation but wastes much time for both bidder and engineer. Another objection is that bidders assume different interpretations of the information they gather.

In order to maintain a uniform method of answering the questions on various apparatus data sheets we have issued a set of suggestions for their preparation and check. The suggestions not only tend to insure uniformity but also make it simple for a new member of our engineering organization to prepare these sheets without any training, whether he is located in the central



APPARATUS DATA SHEET
PURCHASING DEPARTMENT

Project No._____ Inquiry No._____
Account No._____ Date_____ 19__
Oper. Co. No._____

ALTERNATING CURRENT INDUCTION MOTORS

Number required_____

For_____

Railroad destination_____

1 Horse power_____ Speed—synchronous_____ R.P.M.

2 _____ volts_____ phase_____ cycles

3 Duty: continuous_____ intermittent_____; temperature rise_____ °C. For_____ (hours)

4 Type: synchronous_____ squirrel cage_____ wound rotor with standard_____ collector explosion proof_____
constant speed_____ multi speed_____ adjustable varying speed_____ % speed reduction.

5 Designed for full voltage starting_____ and for plugging_____ or non-plugging service_____

6 The motor(s) will be horizontal_____ vertical_____ with standard_____ or_____ inch shaft extension.

7 For: floor_____ wall_____ mounting or ceiling suspension_____
standard frame_____

8 The motor(s) will be: open_____ drip proof cover_____ enclosed pipe ventilated_____ totally enclosed fan cooled_____
drip proof semi-enclosed cover_____

9 To be furnished: with_____ without_____ base or rails—with_____ without_____ standard pulley_____ or special pulley_____
inches diameter_____ inches width, with_____ without_____ flexible coupling and key_____ and with_____ or
without_____ motor_____ or floor mounted magnetic brake for operation on at_____ volts D.C. or_____ volts A.C._____ cycles.

10 For: direct connected_____ belt_____ gear_____ or chain_____ drive.

11 Motor(s) will drive_____

12 Motor(s) will be treated to meet_____
_____ condition, with class_____ insulation.

13 Manufacturer will_____ will not_____ press purchaser's half coupling, rigid_____ flexible_____ type on motor shaft at factory.

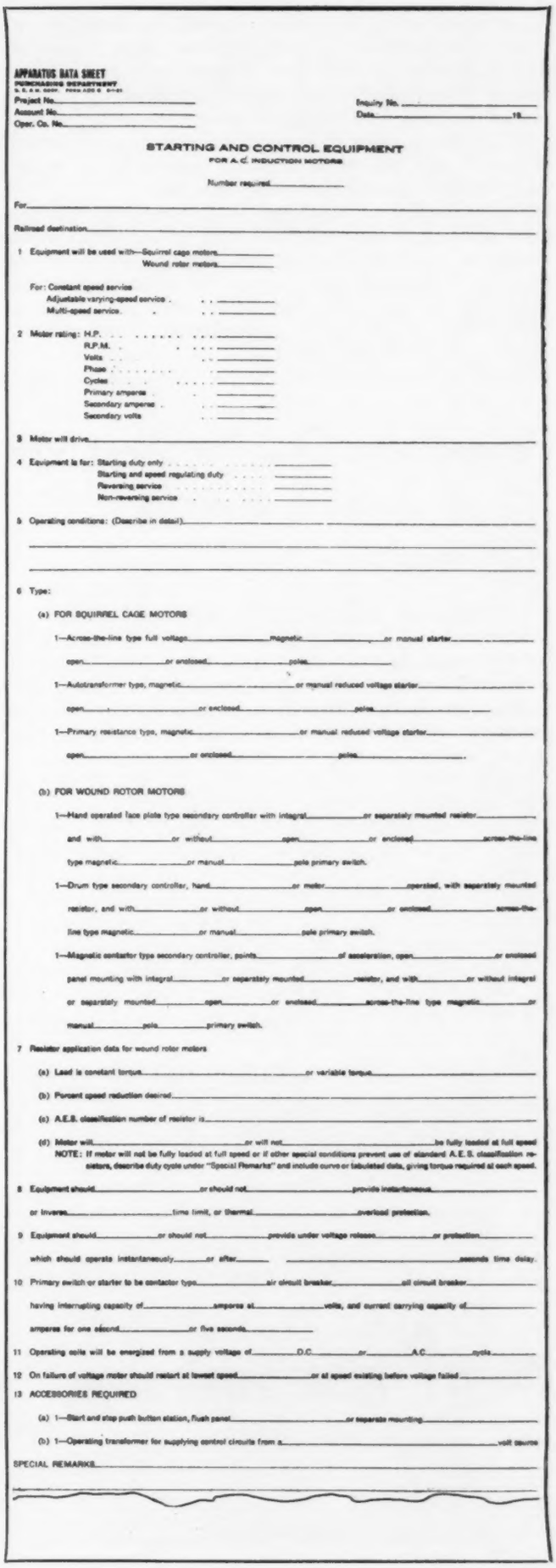
14 Starting torque at_____ % voltage to be manufacturer's standard_____ or special_____ not less than_____ times normal full load torque at full voltage.

15 Starting current at_____ % voltage to be manufacturer's standard_____ or special_____ not to exceed_____ amperes.

16 Quotation should_____ should not_____ include the following information: (1) Starting current (2) Starting torque (3) Full load running current (4) Efficiencies at ½-½-¾ and full load (5) Power factor at ½-½-¾ and full load (6) Outline dimension drawing (7) Type of bearing to be furnished

SPECIAL REMARKS_____

Prepared by_____



APPARATUS DATA SHEET
PURCHASING DEPARTMENT

Project No._____ Inquiry No._____
Account No._____ Date_____ 19__
Oper. Co. No._____

STARTING AND CONTROL EQUIPMENT
FOR A.C. INDUCTION MOTORS

Number required_____

For_____

Railroad destination_____

1 Equipment will be used with—Squirrel cage motors_____
Wound rotor motors_____

For: Constant speed service
Adjustable varying-speed service . . . _____
Multi-speed service . . . _____

2 Motor rating: H.P. . . . _____
R.P.M. . . . _____
Volts . . . _____
Phase . . . _____
Cycles . . . _____
Primary amperes . . . _____
Secondary amperes . . . _____
Secondary volts . . . _____

3 Motor will drive_____

4 Equipment is for: Starting duty only . . . _____
Starting and speed regulating duty . . . _____
Reversing service . . . _____
Non-reversing service . . . _____

5 Operating conditions: (Describe in detail)_____

6 Type:

(a) FOR SQUIRREL CAGE MOTORS

1—Across-the-line type full voltage_____ magnetic_____ or manual starter_____
open_____ or enclosed_____ poles_____

1—Autotransformer type, magnetic_____ or manual reduced voltage starter_____
open_____ or enclosed_____ poles_____

1—Primary resistance type, magnetic_____ or manual reduced voltage starter_____
open_____ or enclosed_____ poles_____

(b) FOR WOUND ROTOR MOTORS

1—Hand operated face plate type secondary controller with integral_____ or separately mounted resistor_____
and with_____ or without_____ open_____ or enclosed_____ across-the-line
type magnetic_____ or manual_____ pole primary switch.

1—Drum type secondary controller, hand_____ or motor_____ operated, with separately mounted
resistor, and with_____ or without_____ open_____ or enclosed_____ across-the-
line type magnetic_____ or manual_____ pole primary switch.

1—Magnetic contactor type secondary controller, points_____ of acceleration, open_____ or enclosed
panel mounting with integral_____ or separately mounted_____ resistor, and with_____ or without integral
or separately mounted_____ open_____ or enclosed_____ across-the-line type magnetic_____ or
manual_____ pole_____ primary switch.

7 Resistor application data for wound rotor motors

(a) Load is constant torque_____ or variable torque_____

(b) Percent speed reduction desired_____

(c) A.E.S. classification number of resistor is_____

(d) Motor will_____ or will not_____ be fully loaded at full speed
NOTE: If motor will not be fully loaded at full speed or if other special conditions prevent use of standard A.E.S. classification resistors, describe duty cycle under "Special Remarks" and include curve or tabulated data, giving torque required at each speed.

8 Equipment should_____ or should not_____ provide instantaneous_____
or inverse_____ time limit, or thermal_____ overload protection.

9 Equipment should_____ or should not_____ provide under voltage release_____ or protection_____
which should operate instantaneously_____ or after_____ seconds time delay.

10 Primary switch or starter to be contactor type_____ air circuit breaker_____ oil circuit breaker_____
having interrupting capacity of_____ amperes at_____ volts, and current carrying capacity of_____
amperes for one second_____ or five seconds_____

11 Operating coils will be energized from a supply voltage of_____ D.C._____ or_____ A.C._____ cycle_____

12 On failure of voltage motor should restart at lowest speed_____ or at speed existing before voltage failed_____

13 ACCESSORIES REQUIRED

(a) 1—Start and stop push button station, flush panel_____ or separate mounting_____

(b) 1—Operating transformer for supplying control circuits from a_____ volt source

SPECIAL REMARKS_____

organization or in the field. It will be necessary to change the forms of these sheets from time to time so their nomenclature will cover current improvements resulting from research and invention. Some have been revised after they have been in use for about a year and a half. Due to their wide distribution among subsidiary properties and the trade it is not practicable to revise them at much shorter intervals than this.

The examples of apparatus data sheets that accompany this article were selected from among those which would be in most common use among purchasers of electrical equipment, not only in the utility but in the industrial field as well. Any buyer, with profit both to himself and to the seller of equipment, can probably use without change the sheets covering alternating-current motors and motor-starting-and-control equipment. The sheets covering outdoor switch houses are applicable as well to industrial primary substations as to utility installations. For convenience of reproduction the sheets are shown here without breaks between pages. Those who adapt the examples shown here to their own uses may be interested to know that the specification for starting-and-control equipment is divided into three sheets, the first one continuing down to section B of item 6 and the second stopping with item 12. The specification on outdoor switch houses consists of two sheets, the first stopping at section B of item 14. The induction motor specification is a single sheet.

▼ ▼ ▼

Regenerative Drag for Sheet Mill

By ARTHUR J. WHITCOMB

Assistant Electrical Engineer
Freyn Engineering Company, Chicago, Ill.

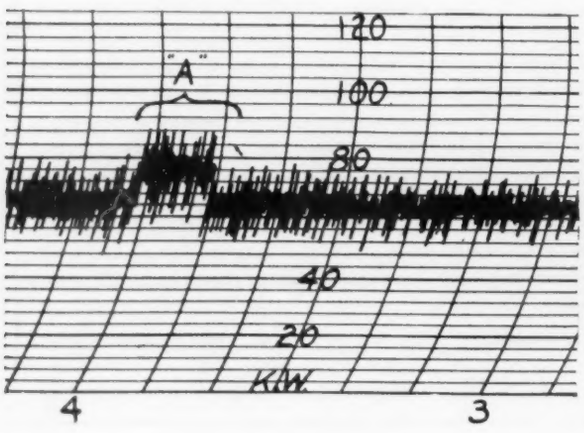
Combining the regeneration of electric power with the production of a dragging torque to prevent backlash in the roll trains of steel sheet mills has been achieved in an installation now operating successfully in a sheet mill in the Detroit district. The equipment comprises a generator and gear unit mounted on the shoeplate supporting the roll housing. The low-speed end of the gear unit is connected to the driven roll at the end of the roll train by means of a special spindle and flexible coupling. The gear unit steps the speed up from 29 r.p.m. to 860. The generator is an 80-kw., 720-r.p.m., wound-rotor induction machine, the power output of which is controlled by means of a secondary resistance. The generator operates at from 5 to 23 per cent above synchronous speed, depending upon the speed of the main drive motor. Constant output is obtained from the generator by varying the resistance in series with the wound rotor. This is done automatically by means of primary and secondary contactors and notch-back relays.

The dragging torque of the generator can be adjusted so as to be just sufficient to prevent backlash in the mill. The power input to the drag as required by this particular mill is approximately 95 kw., while the power output of the generator is 75 kw. On the basis of a 300-day year and with a power cost of 1 cent per kilowatt-hour the actual power regenerated is 540,000 kw.-hr. and represents a saving of $5,400 per year. This power-saving alone pays the cost of the installation in a short time.

The regenerative drag has many other advantages than simply the recovery of power formerly lost. After the electric drag has been adjusted no readjustment due to wearing of friction surfaces is ever required. The close regulation of the new device permits the exact setting of the dragging torque necessary and thus reduces the power input of the mill to that required for the drive and for just sufficient drag to hold the material in the mill in proper tension. With the friction type of drag much of the power input was unnecessarily taken by the drag itself. The magnetic field of the generator serves as a very excellent cushion and thus improves mill performance, as it replaces the rigid mechanical connection between the mill train and the ordinary friction drag. Vibration and chatter are eliminated. The only wearing parts in the regenerative drag are the bearings, brushes and gears. Maintenance is thus reduced over the previous necessity for renewal of bearing blocks employed in the friction drag. Smoke, steam and noise from the friction drag are eliminated.

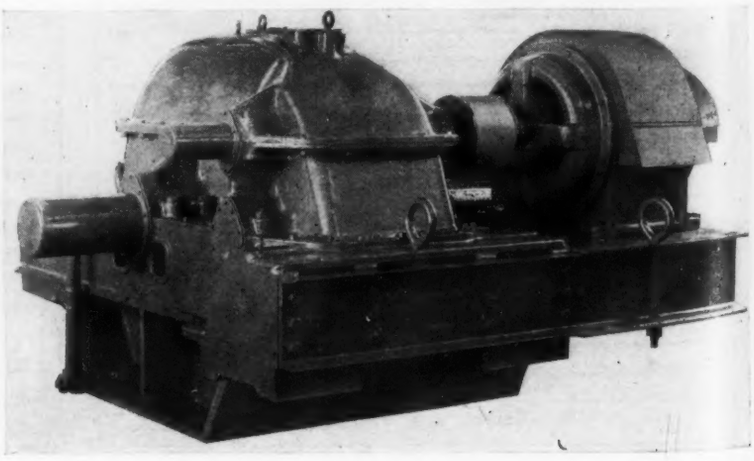
Power output of electric drag

The power output is smoothly controlled. The portion of the chart marked A illustrates how the dragging torque and power output may be increased by decreasing the amount of secondary resistance.



Gear and generator unit of electric drag is compact

The gear unit steps the speed of the rolls up to a speed suitable for electric generation. This reversal of the usual gear function required a redesign of the gear unit.



Metal-Clad Switchgear Selected for Economy and Merit

By L. GRIGSBY
Public Service Company of Oklahoma
R. T. WOODRUFF
Westinghouse Electric & Manufacturing Company

THE Denver Avenue substation in Tulsa, Okla., was built something over ten years ago and was then considered entirely adequate for many years to come. The buses were of open construction both for 13,200 volts and 4,000 volts and the breakers were pipe mounted, remote controlled, manually operated. Within the past five years, because of the rapid growth of Tulsa, it became increasingly evident that the equipment was inadequate for the service it had to perform and would have to be replaced. A short-circuit study made on the system about a year ago indicated that the short-circuit currents the breakers would have to interrupt on the 13,200-volt bus might easily be three or four times the manufacturer's published interrupting capacity. Realization of this fact, together with the hazardous condition of the open bus structure, was emphasized by an oil circuit breaker failure which occurred shortly after and caused the power company's engineers to make plans to rebuild the substation without delay, installing an entirely new 13,200-volt structure and rebuilding the present 4,000-volt structure. It was planned to use the breakers then in use on the 13,200-volt bus in the new 4,000-volt bus, for which duty they were entirely adequate.

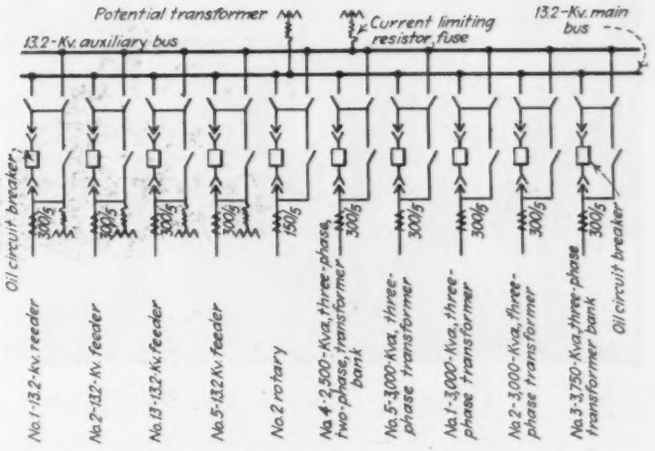


Fig. 1—Single-line diagram of Denver Avenue substation

In view of the importance of this station, it was decided to take every precaution to make it as reliable and safe as possible, with due allowance for future growth and without losing sight of the economic side of the matter. With these ideas in mind all of the bus structures in common use were carefully considered, economic studies made and the respective merits and

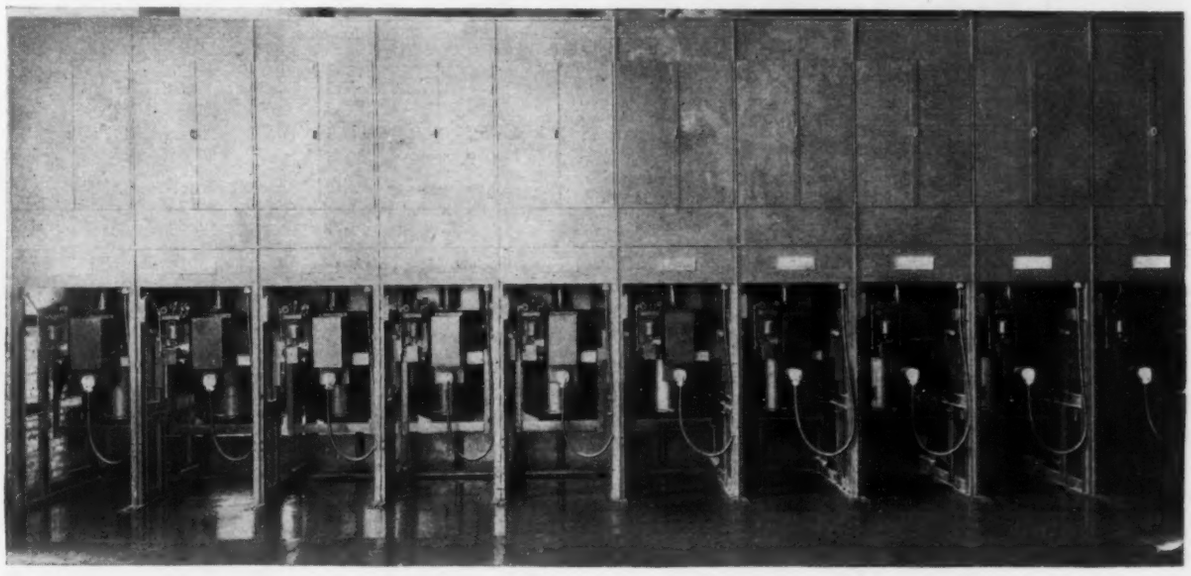


Fig. 2—Front view of 13,200-volt metal-clad switching equipment

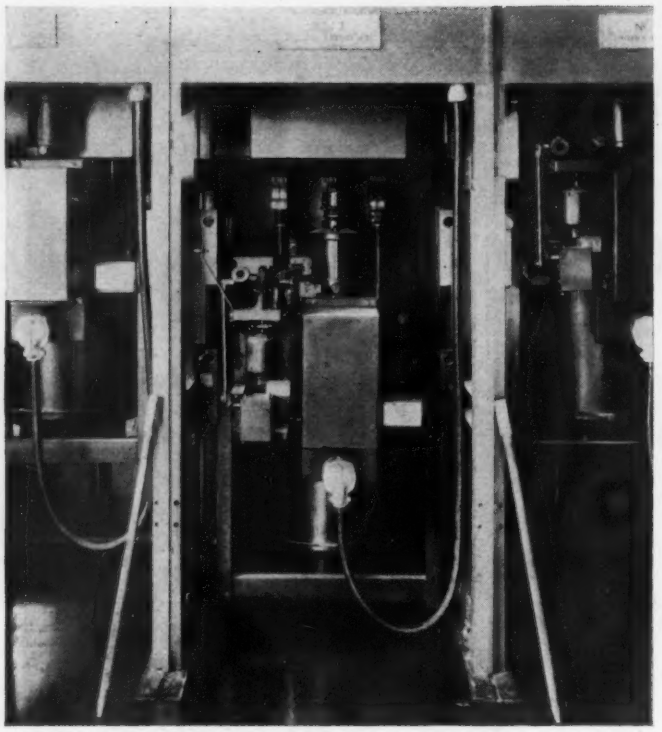


Fig. 3—A 13,200-volt breaker in disconnect position

demerits of each type of equipment compared. After a careful analysis, it was decided that the type of switchgear known as metal clad best met all requirements in the way of compactness, reliability and safety to operators and maintenance men. The ease and speed of installation, as well as the ease of maintenance of the oil circuit breakers carried considerable weight, and the final factor influencing the decision was the fact that the metal-clad switchgear showed a markedly lower over-all cost installed than any other type of equipment of comparable merit.

A one-line diagram of the 13,200-volt equipment as finally built is shown in Fig. 1. Both main and transfer buses were provided, with a suitable arrangement of disconnecting switches to permit any breaker to be withdrawn from service by means of a transfer breaker. The equipment was shipped from the factory in two sections and the installation work consisted merely of skidding the sections onto the foundation, leveling, bolting down and making the bus, cable and control connections. After being set up the breaker alignments were carefully checked and all found to be satisfactory and perfectly interchangeable.

A close-up view of one of the oil circuit breakers withdrawn from its cell and supported by the handling carriage is shown in Fig. 4. The breakers are of the vertical lift-up type with 26-in. diameter tanks and a rating of 250,000 kva. at 13,200 volts. The self-aligning contacts mounted on condenser type terminals are well shown, also the muffler which connects to a header in the structure when the breaker is in service. At the rear of the breaker the ground contact can be seen which makes connection with the ground bus before the main contacts engage, and breaks after they are fully open. A lever on the solenoid-operating mechanism mounted on the front of the breaker engages a cam in the cell compartment mechanically to trip the breaker before it can be lowered when in the operating position and again to trip the breaker when it is being raised to the operating position.

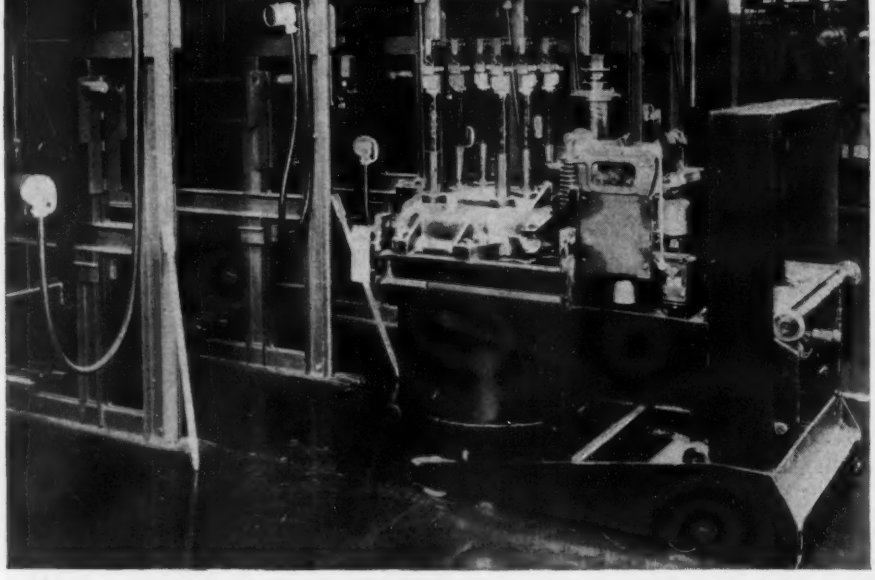


Fig. 4—A 13,200-volt breaker withdrawn from its cell

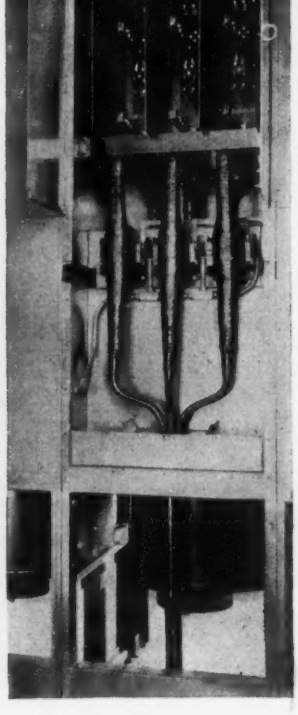


Fig. 5—Rear view of 13,200-volt switching structure

A breaker lowered to the disconnect position is shown in Fig. 3, the breaker resting on lugs provided for that purpose in the structure and the handling carriage withdrawn. In this position the breaker can be operated electrically or manually, the main contacts being completely disengaged. Resting against the front of the structure can be noticed two through-bolts which lock in the breaker in the operating position. The bolts engage holes in lugs which are jig-welded to the breaker and to the frame and maintain the breaker rigidly in position in the structure.

Heavily insulated current transformers used

A rear view of the structure with the doors to the disconnecting switch compartment open and a plate removed to show the current transformers and cable leads is shown in Fig. 5. The buses are mounted in compartments above the disconnecting switches, with the transfer bus in the rear compartment, and are supported on "micarta" bus supports, no porcelain being used in the bus compartments. The compartments are not filled with compound or oil, but the buses are insulated for their full working voltage by "micarta" and varnished cambric insulation.

In this installation, to insure adequate current transformer insulation, it was decided to furnish specially braced and insulated current transformers on this equipment, which accounts for their large size. All cable connections are made as shown in this illustration, the three-conductor lead cable coming underground in ducts below the board and thence to a sleeve in the structure to which the lead sheath is wiped and the individual conductors are formed out under compound to the current transformer terminals. The control wiring is brought into the boxes at the bottom of the structure and from there is carried into the structure in the troughs provided by the supporting channels. The switchboard controlling the switchgear is made of steel panels, and the instruments are square flush type with back-of-the-board illumination. Testing terminals for every conceivable purpose are provided.

It was the intention of the Public Service Company of Oklahoma's engineers to make this a thoroughly modern, economical and reliable installation and the manufacturer was pleased to co-operate with them to the greatest extent in developing and carrying out their ideas as to just what the installation should be.

Guide to Pole Selectives

By J. H. NICHOLS
Albany, N. Y.

Without an attempt to specify definitely one kind of pole over another, I have found the accompanying table useful as a guide in choosing the economic pole to use. It is based on conditions in one locality only and represents therefore a local study of comparative costs and economies. It is useful to engineers and purchasing agents as a check guide and a similar table can be made for data pertaining to different local conditions.

The use of pine poles vs. cedar poles has been under discussion for some time, but up to the present the general price relation has been such that the use of poles for all purposes in this locality has been largely confined to Western red cedar, purchased under standard specifications.

The situation has now changed in such a way as to introduce some use of pine poles. The table given shows the relative dimensions, class, strength, cost delivered in the northeast and are to be used in planning estimates and quickly estimating the cost of comparative lines.

The purchasing department can fill requisitions for poles with cedar or pine of equivalent strength, making the selection from the accompanying table and favoring greatest strength for the least money, except when the requisition specifically states that a certain kind and class of pole shall be used. The restrictions placed upon the use of pine poles are:

(*a*) In the business areas of any community creosoted pine poles should not be used. This is due to public contact and incurring stains and skin burns during hot weather.

This restriction may be canceled in railroad yards, stockyards and along rear-lot-lines where the chance for public contact is not expected.

(*b*) In well-populated residential areas of 2,500 population or over creosoted pine poles are not to be used for the same reasons.

(*c*) Creosoted pine poles are not to be used in lengths of over 50 ft.

A comparison of ground line characteristics shows the obvious recommendation that 50-ft. pine poles should not be used.

Poles—Strength and Cost Comparison, 1931

		Red Cedar Poles				Southern Pine Poles		
For use on the following class service:	Length Pole, Feet	Minimum Class	Circumference Ground Line, Inches	Cost	Strength, Per Cent Over Cedar	Minimum Class	Circumference Ground Line, Inches	Cost
Rural distribution	30	C	30	$11.95	107	C	28	$6.95
Transmission	35	A	40	18.50	104	AAA	37	13.75
Transmission	35	B	36	16.73	106	A	33½	11.30
Rural and urban districts	35	B	36	16.73	93	B	32	10.50
Transmission	40	A	43	21.30	95	AAA	38½	16.85
Transmission	40	B	38	17.91	103	A	35	13.86
Rural and urban districts	40	B	38	17.91	91	B	33½	12.30
Transmission	45	A	45	25.50	93	AAA	40	25.00
Transmission	45	B	40	22.25	105	A	37	21.25
Each class	50	A	47	26.71	91	AAA	41½	28.00
Transmission	50	B	42	25.00	102	A	38½	26.00
Rural and urban	50	B	42	25.00	90	B	37	24.00

Basis—Fiber stress cedar..... 5,600 lb. per square inch.
Fiber stress pine..... 7,400 lb. per square inch.

All the Comforts of Home for 3 Cents an Hour

By DEAN W. TAYLOR
Utility Management Corporation, New York, N. Y.

Residential customer uses 10,000 kw.-hr. per year.

Exercise of rate options leads to increased use.

Seven kilowatts of space heating proves economy.

CAN 10,000 kw.-hr. per year be used profitably in a typical rented house? Can an average family of six use seventeen times as much as the 600 kw.-hr. per year of the present typical user without profligacy, waste or bankruptcy? The answer is "Yes," according to a customer of the Staten Island Edison Corporation, Staten Island, N. Y.

This customer's house, in a typical residential section, has seven rooms, an unusual number of windows and is exposed to prevailing winds of more than average intensity. The building is 30 years old and was remodeled at the time the present occupant leased it. He was told that the house had been "completely rewired." The "complete" wiring job proved to amount to a 30-amp., two-wire service, three-branch circuits and a grand total of four convenience outlets.

During the first few months the only use which could be made of electricity was for lighting by ordinary overhead units and the occasional light-duty appliances such as vacuum cleaner and sewing machine. During this period the average monthly consumption was 50 kw.-hr., just slightly better than the typical average electric customer.

When the members of the family decided they would stay at this address for some time they set about to make themselves comfortable, and as they believed the greatest aid to comfort in the home is electricity, more convenience outlets were installed and more appliances purchased. Two 200-watt floor lamps, an electric refrigerator and a waffle iron were added. The monthly consumption rose to 150 kw.-hr. The three branch circuits served by the 30-amp., two-wire service began to show signs of inadequacy.

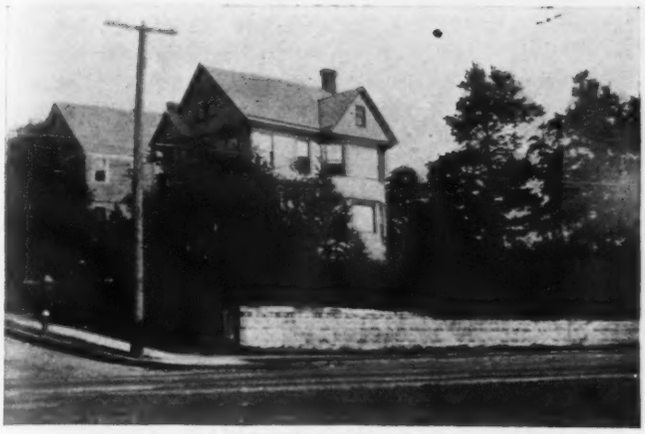
Up to this time the house was served under the Staten Island Edison Corporation's first optional rate, a so-called floor area rate:

Customer charge, cents per month	$0.75
Floor area charge, per month (1,500 sq.ft.)	1.20
Energy charge, cents per kw.-hr.	0.04

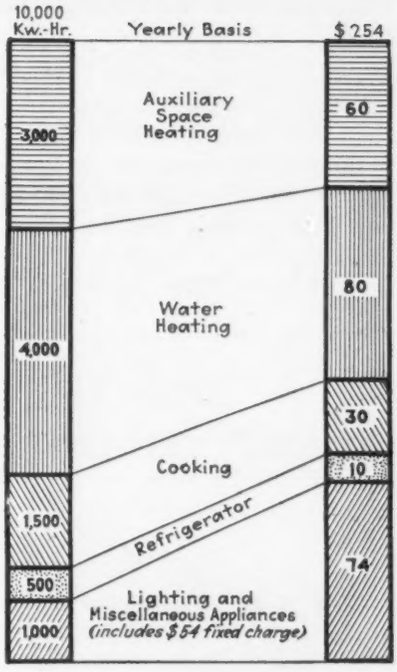
Any increase in monthly consumption would have cost 4 cents per kilowatt-hour. A gas-fired tank heater was being used for hot water service and was found rather inconvenient, so that an automatic water heater was considered. With a gas rate of $1.40 per 1,000 cu.ft. an automatic storage heater would have proved rather expensive and an electric heater was investigated. The

Table I—These Appliances Use 10,000 Kw.-Hr. per Year

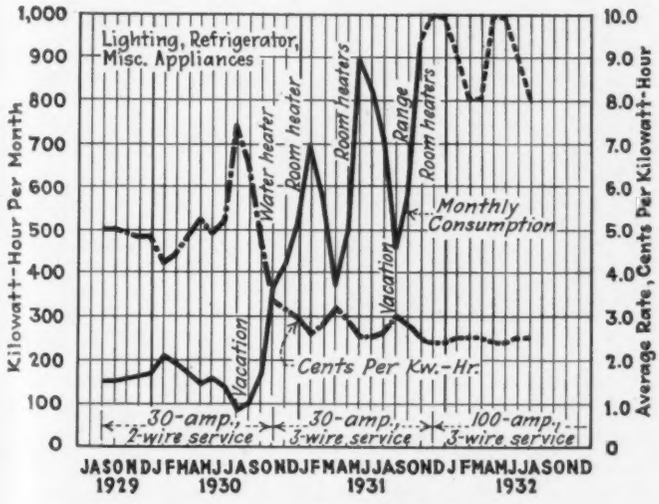
Room	Appliance	Watts	Price
Kitchen	Range	8,500	$150
	Water heater	2,000	150
	Refrigerator	200	200
	Electric fireless cooker	1,000	10
	Dishwasher	200	100
	Tea kettle	1,000	6
	Electric iron	500	6
	Electric egg beater	100	21
	Cream mixer	50	5
	Corn popper	400	2
	Lighting units	150	18
Breakfast and dining room	Auto-toaster	1,000	10
	Room heater	1,000	10
	Room heater	1,000	10
	Waffle iron	1,000	15
	Lighting	150	20
Living room	Room heater	1,000	10
	Room heater	1,000	10
	Radio	100	200
	Lighting	600	45
	Vacuum cleaner	100	50
Bedroom	Room heater	1,000	10
	Sewing machine	50	50
	Heating pad	60	6
	Curling iron	40	5
	Lighting	100	10
Bedroom	Room heater	1,000	10
	Health lamp	500	15
	Electric toys	200	30
	Lighting	100	10
Bathroom	Room heater (fan type also used for hair drying)	1,000	15
	Lighting	100	8
Miscellaneous and lighting		500	50
	Appliances (26) and lighting units	26,620	$1,217
	Annual energy consumption, kw.-hr.	10,000	.....
	Maximum demand, kw	9	.....
	Annual electric bill	.....	$254



This rented home uses 10,000 kw.-hr. per year



Home comfort and electrical convenience for $254 per year



Promotional rate develops 1,000 kw.-hr. per month per customer

Twenty-seven kw. of appliances served for $254 per year on a 2-cent energy rate with $4.50 of initial fixed charge.

monthly consumption of the electric heater was estimated at 350 kw.-hr. and with this consumption the Staten Island Edison Company's second optional or "large use" rate was found to be still more attractive than the first optional rate, as it would permit the water heater to be served at 2 cents per kilowatt-hour. The "large use" rate was as follows:

Customer charge, per month	$3.00
Floor area charge, per month (1,500 sq.ft.)	1.50
Energy charge, cents per kw.-hr.	0.02

With the installation of the water heater the monthly consumption increased to approximately 500 kw.-hr. and the cost of automatic water heating was found to be approximately $7 per month. The installation of the 2-kw. water heater necessitated the change to a 30-amp., three-wire service. At the same time two additional branch circuits were installed for serving additional convenience outlets. With what now appeared to be an adequate service installation the family gradually came to use more and more appliances and the monthly consumption increased to 600 kw.-hr.

Auxiliary electric heating adopted

During the late spring and early fall months it was found difficult to operate the coal-fired furnace in such a way as to provide adequate heating during the early hours of the day and not overheat the house during the middle of the day and at the same time not allow the fire to go out. It was found that if the furnace was operated continuously during this period it burned approximately two-thirds as much coal as it did in the colder months and at times there was serious overheating, resulting in discomfort and liability to colds, and it appeared that some form of auxiliary heating would be desirable during these periods from the standpoint of health, convenience and economy. Two 1,000-watt portable heaters were purchased, one for the bathroom and one for use in the living room late at night, or in the breakfast room until the outdoor temperature rose to normal in the morning. These heaters were found so satisfactory that two more were purchased for the living room, two for the dining room and one for use wherever needed.

During the period when electric heating was used entirely (in late spring and early fall) 400 kw.-hr. per month went for this service. During the real winter season 200 kw.-hr. was used for auxiliary heating and found economically justifiable and extremely convenient. The use of auxiliary electric heat enabled the furnace to be shut down a total of eight weeks and to be operated more economically throughout the heating season. The use of this amount of auxiliary electric heat naturally reduced the amount of anthracite coal burned and, what was equally pleasing, eliminated much of the dirt and expense of ash removal. The basement was noticeably cleaner and less ashes and dirt were brought up into the house. There was no running to the basement half a dozen times a day to look after the furnace and there were fewer ash cans to be set out in the yard each morning.

During the heating season previous to the use of auxiliary electric heat twenty tons of pea coal was used, costing $200. During the following season, when auxiliary electric heat was used, eleven tons of coal were burned, costing $110. About two tons of this reduction was attributed to the slightly warmer winter season. The

Table II—Electricity Can Compete in Cost with Other Forms of Residential Service

	Annual Cost with Complete Electric Service		Cost with	
	Annual Kw.-Hr.	Annual Cost	Alternate Services	
Home lighting and miscellaneous appliances	1,000	$74.00	$74.00	Electricity the only possible service charged at full use rate, $4.50/Mo. plus 2.0 cents per kw.-hr.
Refrigeration	500	10.00	60.00	For equivalent amount of ice refrigeration
Cooking	1,500	30.00	40.00	Gas at $1.40/M cu.ft
Automatic water heating	4,000	80.00	90.00	Gas at $1.40/M cu.ft.
Auxiliary space heating	3,000	60.00	70.00	Coal at $10.00 per ton
	10,000	$254.00	$334.00	
Saving with electricity		$80.00		

balance of seven tons saved was entirely due to the use of electric heat, less than a quarter ton being used from April to November. The coal saving was realized not only from keeping the furnace shut down for eight weeks but also from the elimination of the necessity of forcing the fire every morning in order to get the house warm by breakfast time. The coal saving of seven tons, or $70, was increased by the saving in ash removal, costing $1 per ton, or $7, and the expense of cleaning the basement, $3, a total annual money saving of $80. The electric heaters consumed during the nine-months heating season a total of 3,000 kw.-hr., costing $60 and showing a money saving of $20, without counting an added value in convenience and flexibility of at least twice that amount.

With 7,000 watts of space heating added to the growing appliance and lighting load the 30-amp., three-wire service was found entirely inadequate. As an electric range was being considered it was found necessary to remove the 30-amp service and install a 100-amp. service. At the same time the original number of three-branch circuits, which had grown to seven, was further increased to eleven. Four additional convenience outlets were installed. The house now had an even dozen convenience outlets and it was beginning to be possible to use all the appliances without resort to "haywire" connections from overhead lighting units.

It was now possible to add an 8-kw. electric range. The gas range had cost an average of $3.50 per month and the electric range, using 125 kw.-hr. per month, cost only $2.50 per month and was found superior in cooking results.

With the house thus more or less completely electrified the monthly consumption during the winter months now reaches 1,000 kw.-hr. and for the year exceeds 10,000 kw.-hr. The cost of this most liberal use of electric service is only $254 per year, less than 72 cents per day, or 3 cents per hour. In other words, auxiliary heating, electric cooking, automatic water heating, electric refrigeration, lighting and the dozen or more applications of portable electric appliances are made possible at an annual cost less than the depreciation item alone on a $1,500 automobile.

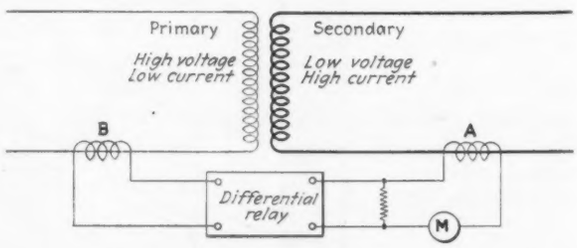
▼

Matching Ratio Errors Improves Differential Relaying

By E. C. WENTZ

Transformer Engineering Department, Westinghouse Electric & Manufacturing Company, Sharon, Pa.

Differential protection of power transformers is often accomplished through the medium of current transformers of the ring or bushing type. It is well known that the magnitude of the ratio and phase-angle errors of this type of transformer depend on the nominal current rating, transformers for the lower values of primary current having much greater errors. The difference in magnitude of normal secondary and primary currents of the power transformer is generally great enough to make this inherent characteristic of bushing current transformers a troublesome relay problem.



Relay bushing transformers can be compensated by artificial burden

This situation can be met by introducing into the

Table III—Earned Rate Is Halved by Full Use in Electrified Home

Month	1929 Kw.-Hr.	1929 Bill	1929 Average Rate, Cents	1930 Kw.-Hr.	1930 Bill	1930 Average Rate, Cents	1931 Kw.-Hr.	1931 Bill	1931 Average Rate, Cents	1932 (Estimated) Kw.-Hr.	1932 (Estimated) Bill	1932 (Estimated) Average Rate, Cents
January	...	.....	...	208	$8.66	4.2	702	$18.54	2.6	900	$22.50	2.5
February	...	.....	...	192	8.34	4.4	568	15.86	2.8	800	20.50	2.5
March	...	.....	...	166	7.82	4.8	376	12.02	3.2	800	20.50	2.5
April	...	.....	...	142	7.34	5.2	490	14.32	2.9	1,000	24.50	2.4
May	...	.....	...	156	7.62	4.9	900	22.48	2.5	1,000	24.50	2.4
June	...	.....	...	139	7.28	5.2	824	20.98	2.5	900	22.50	2.5
July	...	.....	...	84	6.18	7.4	708	18.66	2.6	800	20.50	2.5
August	150	$7.50	5.0	100	6.50	6.5	454	13.58	3.0	.....	.....	...
September	150	7.50	5.0	167	7.84	4.7	588	16.26	2.8	.....	.....	...
October	155	7.66	4.9	364	11.78	3.3	936	23.22	2.5	.....	.....	...
November	161	7.70	4.8	420	12.90	3.1	*1,000	24.50	2.4	.....	.....	...
December	166	7.82	4.8	518	14.86	2.9	*1,000	24.50	2.4	.....	.....	...

*Estimated.

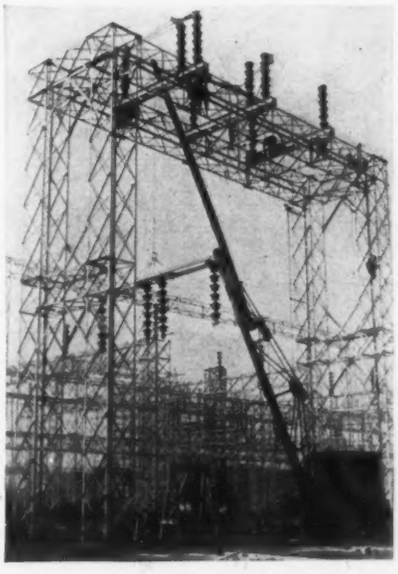
secondary circuit of the bushing current transformer on the secondary (large-current) side of the power transformer an artificial error which will match the performance of the current transformer on the high-voltage side.

This amounts to adjusting the magnitudes of the required exciting currents of the two transformers so that they will be equal in effect. This can readily be accomplished by paralleling the existing relay burden on the high-current transformer with an auxiliary core so designed that the vector residue which passes to the relay will be in error by the amount of the exciting current for this core; thus the differential relay gets practically equal actuating currents under normal operating conditions of the power circuit through the transformer. The auxiliary core will introduce the proper corrective effect if it is an exact duplicate of the current transformer on the high-voltage, low-current side.

This scheme is useful in avoiding the greater expense of a wound-type current transformer for the low-current, high-voltage side in an effort to gain the desired accuracy of transformation for differential relay protection. Meters inserted in the low-voltage, high-current side should be connected ahead of the artificial burden in order to respond to the full secondary current of the current transformer.

▼

Group Erection with Crane Saved Time, Reduced Hazard



Expense of assembling the 220-kv. oil circuit breakers and related equipment at the Newark substation of the Pacific Gas & Electric Company was reduced about two-thirds by use of the engine-driven crawler crane illustrated. Moreover, much of the hazard to workmen in erecting equipment piece by piece on the structure was eliminated by group assembling.

This machine is normally equipped with a 35-ft. steel boom, but because of the height required in placing the disconnecting-switch assembly and various steel members it was found necessary to lash a 35-ft. spar to the boom. This made possible the erection of steel and the placing of equipment at an elevation of 60 ft. above the ground. The heaviest piece of equipment was the disconnecting-switch assembly weighing 2,900 lb., which was completely assembled on the ground and raised to position on the towers.

READERS' FORUM

Hydro vs. Steam Costs

To the Editor of the ELECTRICAL WORLD:

The ELECTRICAL WORLD of December 12, 1931, carries a story by Geo. A. Orrok, with the title "Water Power in Its Economic Aspect." Mr. Orrok has made a faulty analysis and much that he has written is not well taken. It is unfortunate that any engineer should publish his personal views on a question like this. Both the public and the investor are interested in the proper selection of the generating unit.

If we are to compare the two methods of production, they should be compared in equal sizes, with equal power factors and equal operating time, and the cost analyzed at the outgoing switchboard. I think the writer of the article falls into the double error of comparing unequal sizes and unequal transmission and it complicates what he is trying to explain.

It is faulty to charge against a hydro plant the cost of transmission from plant to where it is used. Cost of manufacture of power is the cost on the switchboard, and yet Mr. Orrok says that to the cost of a hydro plant must be added "step-up and step-down transformers, rights-of-way and transmission lines and substations, with transformers, condensers and switching apparatus to the market, which may easily add $100 per kilowatt to the above figure."

The present power situation in this country is very well known, for the Federal Trade Commission has certainly uncovered a great amount of facts. The present operating companies serve very large territories and from both fuel and hydro-electric plants.

Systems must be so designed and are so designed that, no matter what plant may be shut down, the power can be brought in from some other source. The item of power costs must be divided into its accepted groups and each is distinctly an item in itself, such as "plant cost," "transmission cost," "distribution cost," "retirement cost," "insurance and tax costs," etc.

Go most anywhere in this country and you will find the situation where a large industry is located, say, about 50 miles from some large utility hydro-electric plant, and in an opposite direction will be located this same utility's steam-electric plant, which will be at about the same distance from the industrial plant. Is it fair to charge against the hydro plant the cost of this 50 miles of transmission to reach this industry and not charge against the steam plant this same 50 miles of transmission line required to reach it?

The item of transmission is as separate an item of ultimate cost of power as is "interest on bonds" and simply is chargeable to ultimate cost to consumer. It makes no difference if the transmission is from a hydro plant or a steam plant.

If a hydro-electric engineer took the stand that New York City should get its power from Niagara Falls and do away with the large steam plants in New York City, it would be just as revolutionary and contrary to common sense as to say that Niagara Falls should be supplied by power from the New York City steam plants. Suppose, for the sake of clarifying this issue, that such

was the case. Would the cost of transmission be charged against the hydro plant at Niagara Falls and not against the steam plant at New York City in the reverse case?

Mr. Orrok mentions the high cost of building hydro-electric plants. It is granted that any modern hydro plant costs more to build than a steam plant, due to the fact that much more land for storage pond must be had and construction is done in water, yet there is a vast difference between the figures given in this article and the prices developed in sworn testimony before the Federal Trade Commission. This article says: "This cost (hydro plant cost) has been increasing, and in 1920 the average cost had risen to $150 per kilowatt. In 1920 the actual figures ranged from $200 to $250 per kilowatt, while today the average of all undeveloped sites has been variously estimated as running from $300 to $600 per kilowatt."

Referring to the Federal Trade Commission hearings and reports there are listed costs of both steam and hydro plants. Here are some of the figures:

Items	Company A Per Horsepower	Company B Per Kilowatt
No. 1 hydro plant	$83.10	$116.74
No. 2 hydro plant	$146.00	$115.27
No. 3 hydro plant	$91.50	$176.50
No. A steam plant	$71.00	

I have before me a summary of costs (confidential) made for rebuilding, or building new, 87 hydro-electric plants. These estimates were compiled about sixteen months ago. The size of the plants varies from 70 hp. to 45,000 hp. The cost per kilowatt varies from $80 to $250, with the average being about $160. The higher costs per kilowatt are for the smaller-sized plants.

Investigations show that small water powers often have much higher cost per kilowatt of construction, but they carry a much lower overhead than large hydro plants, thus tending to equalize the economy. In fact, investigations show small hydro plants to be the most economical investment, and I quote from page 14 of report No. 28, Senate Document 92, on "Utility Corporations," the sworn statement of a witness after his survey of properties and companies' records:

> As a result of the merging of various electric utility companies during the course of time a number of small hydro and steam-electric plants have been acquired. It can be shown that small hydro plants, even if proportionately expensive in operation as compared with large modern plants, nevertheless may well be worth operating for the kilowatt-hours they may generate when tied into a large system to replace coal or to conserve water storage back of large stations. Such small plants often are useful in assisting in voltage regulation when situated near the ends of long or light transmission lines, a benefit particularly needed during periods of scarcity of water at such plants. With very little water the generators can be run as synchronous condensers to improve the voltage on the lines which are then supplied with energy wholly from a distance. Some of them may not be considered worth their cost of reproduction, and therefore if not existent would not now be built, but once in existence they can be operated at a gain over operating cost, though often without reasonable profit on the original or reproduction cost thereof. Detailed figures illustrating the principle of this situation will be presented in a report on the ——— Power & Light Company operation.
>
> The situation regarding small and old type steam stations is wholly different. Except for districts in which the prospective business does not justify the construction of adequate transmission lines, the operation and maintenance expense of small stations is so high that their continuance is uneconomic.

Let us look at some figures given in as exhibits in sworn testimony before the Federal Trade Commission. They would represent a territory of about 5½ per cent of the area of the United States:

	Production Costs in Cents per Kilowatt-Hours			
	Year, 1929			Year, 1928
Items:—	Company A	Company B	Company C	Company D
Hydro plant operation	0.0224	0.0322	.....	0.044
Steam plant operation	8.1300	9.5500	.....	4.499
Cost of purchased power	0.2330	0.5580	.....	0.444
Total plant production cost	0.1066	0.2138	0.1285	0.048
Next is added:				
Transmission costs	0.0231	0.0135	0.0849	0.045
Distribution costs	0.0500	0.1249	0.0535	0.071
Utilization expenses	0.0090	0.0253	0.0123	0.002
Consumer's cost	.....	.....	.....	0.039
Commercial expense	0.0185	0.0607	0.0419	0.037
New business	0.0175	0.0529	0.0081	.....
General expenses	0.0914	0.0827	1.1632	0.125
Insurance	.....	0.0070	.....	.....
Injury and damage	.....	0.0185	.....	.....
Total operating expense	0.3161	0.6179	0.4922	0.395
Next add:				
Retirement expense	0.0623	0.0749	0.1585	0.072
Taxes and license	0.1117	0.1196	0.1700	0.201
Grand total costs	0.4904	0.8124	0.8207	0.668

You will notice that rightly (in any modern electric power system) costs are chargeable as they are listed above and that transmission costs are not and cannot be charged against hydro plants any more than they should be charged against steam plants and so they are listed under separate charges.

True comparisons of cost at the switchboard can only be made when the same load factor and time factor are used. For example, it would be unfair to compare a steam plant cost with only a 10 per cent load factor as against a hydro plant with 60 per cent load factor or more. It would make the steam plant costs so excessive.

Refer to U. S. government report No. 30 for a good example for comparison. The case, I believe, refers to a most modern large steam plant built practically at the mouth of a mine so that no coal haul is needed and the load factor is 57.2 per cent of the time. There is also shown the modern hydro plant cost where plant is operating at a factor of 58.2 per cent of the time. Very close, and surely close enough for comparison of costs between steam and water power plants and we see:

	Cents per Kw.-Hr.
Production cost in hydro plant is	0.0181
Production cost in steam plant is	0.3890

This is proof in one case at least that steam power costs actually 21½ times more than hydro power.

In conclusion, if Mr. Orrok is right, then how can one explain away the facts that the power companies all over this country are continuing to seek all the water powers they can get?

Atlanta, Ga. **H. H. WHITE.**

▼

Substation Area Incorrectly Stated

To the Editor of the ELECTRICAL WORLD:

The land area required for the outdoor installation is given as 172 per cent in the article "Reading Frequency Changers Installed Outdoors" in the December 26, 1931, issue (page 1142). The correct value is 127 per cent.

F. R. FORD,
Assistant Engineer Inside Plant,
Philadelphia Electric Company.

Men of the Industry

G. C. Ward Appointed Senior Vice-President

George C. Ward, who was recently appointed senior vice-president of the Southern California Edison Company, as announced in the January 2 issue of the ELECTRICAL WORLD, has had a distinguished career in the engineering field. Under his direction the great engineering projects of the Southern California Edison Company, starting with the hydro development at Big Creek on the upper San Joaquin River in Fresno

County and culminating in the 500,000-hp. steam plant in Long Beach, have been carried out.

California, however, was not Mr. Ward's native state. He was born at White Plains, N. Y., and was graduated from Phillips Academy at Andover, Mass. He entered the employ of the North River Construction Company and subsequently became associated with Dr. W. Seward Webb. It was during this association that he attracted the attention of Collis P. Huntington, builder of the Southern Pacific Railroad, and Henry E. Huntington. It was at the instigation of Henry E. that he removed to California.

Mr. Ward became vice-president of the Pacific Light & Power Corporation and when that utility was merged in 1917 with the Southern California Edison Company be became vice-president in charge of construction and operation. Three years ago he was made executive vice-president, the position he occupied until his recent appointment. Two honorary degrees have been conferred on Mr. Ward for his outstanding achievements in the engineering field, the University of Southern California honoring him with the degree of doctor of engineering and Oberlin College conferring upon him the degree of doctor of science.

▼

F. W. Clements Heads Australian Commission

F. W. Clements has been appointed chairman of the State Electricity Commission, according to an announcement made by the Premier of Victoria, Australia, to succeed the late Sir John Monash. Mr. Clements is a native of Halstead, Essex, and received his education in London and Germany. He joined the staff of the Brush Electrical Engineering Company, Ltd., in 1881, remaining with the company for many years and supervising important electrical installations in England and on the Continent. In 1887 he went to Austria-Hungary to carry out electrical work, and he was engaged again in Russia, Italy and various Balkan States. Subsequently, he accepted an appointment with the County of London Electric Supply Company.

In 1900 Mr. Clements went to Australia, joining the staff of the Melbourne Electric Supply Company, Ltd., which had been formed by the amalgamation of the New Australian Electrical Company and the A. U. Alcock Electric Supply Company. As chief engineer and managing director of this merger, Mr. Clements gained a reputation as the organizer of many extensive electrical undertakings. He retained his position with the Melbourne company until 1930, when the company, under the terms of an agreement which was entered into on the authority of Parliament in 1924, was taken over by the State Electricity Commission. He was appointed a part-time commissioner in 1926.

Mr. Clements, who is one of the best-known figures in the electrical industry of the commonwealth, is a member of the Institution of Electrical Engineers, an associate of the American Institute of Electrical Engineers and a member of the Australian Institute of Engineers.

▼

WILLIAM E. UMSTATTD has been made executive vice-president of the Timken Roller Bearing Company, Canton, Ohio. Mr. Umstattd has been with the Timken organization for thirteen years, during the last two years of which he has occupied the capacity of factory manager.

J. C. Boyle Directs Operations for Western Utility

J. C. Boyle, recently elected vice-president in charge of operation of the California Oregon Power Company, as announced in the December 5 issue of the ELECTRICAL WORLD, was graduated from the University of California in 1910 and immediately became associated with the Siskiyou Electric Light & Power Company of Yreka, Calif. His broad experience in the public utility business began with surveys which he made on the California Oregon Power Company's No. 1 hydro plant on the Klamath River and the transmission line extending from this hydro station to Ashland, Ore.

From 1911 to 1916 he was engineer in charge of construction on the Copco

No. 1 plant. From 1916 to 1918 he was assistant engineer of the California Oregon Power Company and superintendent of construction on the Copco No. 1 plant. The following three years he was assistant engineer for the California Oregon Power Company, in charge of the following projects: Castella-Kennett line, Fall Creek fish hatchery, Link River Dam, regulation of Upper Klamath Lake, investigations on Rogue River and Klamath River, headquarters at Medford and Klamath Falls. For a period of eight years he occupied the position of division manager of the Klamath division of the California Oregon Power Company with headquarters at Klamath Falls, Ore. In the fall of 1929 he was appointed assistant general manager of the California Oregon Power Company with headquarters at Medford, Ore.

▼

A. V. COLEMAN, formerly manager of the Randolph & Holbrook Power & Electric Company, Quincy, Mass., and for some years associated with the Weymouth Light & Power Company, has been appointed manager of the Southeastern Massachusetts Power & Elec-

tric Company, Wareham, Mass., succeeding Harry B. Ivers, who has been assigned to field research work by the New England Power Association, operator of these properties.

•

GEORGE W. WOODRUFF and FREDERICK P. GRUENBERG were reappointed members of the Public Service Commission of the State of Pennsylvania by Governor Pinchot.

▼

W. L. Fitzpatrick Assumes New Executive Duties

W. L. Fitzpatrick, who was elected vice-president and treasurer of the Mountain States Power Company, as announced in the December 5 issue of the ELECTRICAL WORLD, entered the public utility field as an employee of the Tacoma Gas Company, a Byllesby property, in 1912. Advancing in the ranks, he was made assistant treasurer in 1918, and in 1922 was made treasurer and auditor of the Tacoma Gas & Fuel Company, Tacoma, Wash.; Olympia Gas Company, Olympia, Wash., and Puget Sound Gas Company, Everett, Wash. In 1925 he was made assistant treasurer and general auditor

of the Mountain States Power Company, at that time consisting of seven divisions operating in Washington, Oregon, Idaho, Montana and Wyoming, with general offices in Tacoma, Wash.

After spending sixteen years with the company in Tacoma, the properties located in Tacoma, Olympia and Everett were sold, and Mr. Fitzpatrick was transferred to Albany, Ore., his present headquarters.

▼

OBITUARY

CHARLES E. NEILL, vice-president and managing director of the Royal Bank of Canada, died December 16 in Montreal after an illness of two months. He was 58 years of age. Mr. Neill was an outstanding figure in banking and industrial circles in Montreal. He was a past-president of the Canadian Bankers' Association and was also a governor of McGill University. Mr. Neill was a director of the Montreal Trust Company, Sun Life Assurance Company, Northern Assurance Company, Dominion Bridge Company, Shawinigan Water & Power Company and of the Beauharnois Power Company.

•

J. C. MATTHIEU, vice-president and a director of the Dayton (Ohio) Power & Light Company, in charge of commercial development, died January 3 at his home in that city in his forty-eighth year. Mr. Matthieu had been identified with the Dayton utility for approximately 23 years. At first he was engaged in promotional work on electrical vehicles and later, becoming interested in power sales, he devoted his attention to this branch of public utility work until 1918. Subsequently he was appointed commercial manager and following the consolidation of the Dayton Gas Company with the Dayton Power & Light Company in 1928 he was elected vice-president in charge of commercial development, in that capacity directing all commercial development of the company until his death. Mr. Matthieu was active in the affairs of the East Central Division of the National Electric Light Association, having served as chairman of several committees. He received a B.S. degree from the University of Maine and before making a connection at Dayton he was identified with the Dean Electric Company of Elyria, Ohio.

•

JOHN DICKENSON, a pioneer in the promotion of water-power development in Ontario and the last of the "five Johns" who established the Dominion Power & Transmission Company, died January 3 at his home in Hamilton in his eighty-fifth year. Mr. Dickenson had been in failing health for several months. He was widely known in Hamilton as an associate of the late Sir John Gibson, the late John Moodie, the late John Sutherland and the late John Patterson in developing hydro-electric power at Decew Falls and transmitting it to Hamilton to supplant the gas lights and the steam motive power of Hamilton's industries. The company was known at that time as the Cataract Light & Power Company, forerunner of the Dominion Power & Transmission Company, which was sold a short time ago to the Ontario Hydro-Electric Commission. Mr. Dickenson held a large share of the original stock in the Cataract and the Dominion companies, which he retained until the company was absorbed by the Ontario commission. He was also prominent in politics, having been a member of the Ontario Legislature for twelve years.

•

EDWARD H. GORSE, who was for a period of ten years secretary-treasurer of the Central Power & Light Company, San Antonio, Tex., died December 8 in St. Louis in his seventy-third year. Mr. Gorse joined the Morrison and McCall utility interests at St. Louis in 1914, after a wide experience in the business world. Two years later he was made secretary-treasurer of the San Antonio utility and held this position until 1926, when he retired.

•

WILLIAM E. LEWIS, lawyer and long prominent in the public utility field in Utica, N. Y., died at his home in that city January 2. He was one of the organizers of the Utica Electric Light & Power Company, and in 1899 with his partner, M. Jesse Brayton, bought the water rights of Jenskins and Pettibone on the West Canada Creek, and other adjacent rights, and built the hydraulic plant at Trenton. After the merger of the Utica Electric Light & Power Company and the Equitable Gas & Electric Company into the present Utica Gas & Electric Company Mr. Lewis served as vice-president for many years.

•

GILBERT W. GOODRIDGE, vice-president of the Bead Chain Manufacturing Company and prominently connected with the Bryant Electric Company, Bridgeport, Conn., died January 5 at the Bridgeport Hospital following an illness of two months. Mr. Goodridge was born in Chicago in 1874 and at an early age became associated with the electrical industry. He started at the Chicago branch of the Bryant Electric Company and in 1899, when that company acquired the Perkins Switch Company, Hartford, he became resident manager at Hartford. In 1902 he joined the Bridgeport plant and was named general superintendent of the combined companies, the Perkins company being consolidated with the Bryant company at Bridgeport. He became assistant general manager in 1904 and held that office until 1928, when he retired. Mr. Goodridge became one of the founders of the Bead Chain Manufacturing Company, which was established in 1924, and was actively associated with the company in an engineering and executive capacity. He was an inventor of some note, having 70 patents to his credit, the best known, perhaps, being the present type of electric light socket for incandescent lamps.

Trade News

Gentsch & Thompson Become G. E. Range Distributors

Gentsch & Thompson, Inc., have been appointed distributors for eastern Massachusetts, the Cape Cod district and Rhode Island for ranges of Edison General Electric Appliance, Inc., manufacture, with headquarters at 11 Deerfield Street, Boston, Mass. This house has been handling General Electric refrigerators for some time and will push electric range development along similar lines in eastern New England.

▼

General Electric Lamp Sales Offices Combined in Boston

To centralize lamp sales and service for the New England district in one office, the National Lamp Works and Edison Lamp Works of the General Electric Company consolidated their sales offices as of January 1 at 211 Park Square Building, Boston, Mass., under the designation of the incandescent lamp department, New England division of the company.

Arthur W. Marcou, formerly manager of the New England division of the National Lamp Works, has been appointed manager of the department, and Herbert F. Wallace, former manager of the Edison Lamp Works in the same territory, has been appointed special sales representative, transferring from the district offices of the General Electric Company at 140 Federal Street, Boston. The territory includes all of New England except the western part of the state of Connecticut.

▼

Robert D. Mowry, elected president of the National Battery Manufacturers' Association at the annual meeting held in Cleveland October 22 and 23, has recently completed appointment of standing committees for 1932.

•

Beginning November 1, the Union Metal Manufacturing Company, Canton, Ohio, became the exclusive selling agency for Concrete Lighting Standards, as well as other products manufactured by the American Concrete Marbelite Company of Chicago, Ill. Distribution of these products will be handled through the medium of the Union Metal Manufacturing Company's national agencies, the Graybar Electric Company, Inc., and the General Electric Supply Corporation. The new concrete lighting standard will be marketed under the name of "Spun-Crete."

•

Announcement has been made by the Lincoln Electric Company of the appointment of R. D. Eaglesfield as district manager in charge of motor and welder sales with headquarters in Indianapolis.

•

J. L. Busey, manager of the Boston office of the General Electric Supply Corporation, has been appointed manager of appliance sales for the country east of the Rocky Mountains, with headquarters at the Bridgeport, Conn., office of the General Electric Supply Corporation.

•

Announcement has been made by the Industrial Products Sales Corporation, St. Louis, Mo., of the opening of a branch sales office at 134 North Brighton Street, Kansas City, Mo. H. M. Shour is the Kansas City branch manager. The corporation is distributor for the Electric Railway Equipment Company, Cincinnati, Ohio; Condenser Corporation of America, Jersey City, N. J.; Hardwick & Hindle Company, Newark, N. J.; Electric Fittings & Equipment Company, Detroit, Mich.; Southern States Equipment Company, Birmingham, Ala., and the American Foundry Equipment Company, Mishawaka, Ind.

•

Commencing January 1, General Electric Hotpoint appliance business is handled by the merchandise department of the General Electric Company with headquarters at 1285 Boston Avenue, Bridgeport, Conn. Appliance business of the Simplex division is handled by the same department at Bridgeport.

•

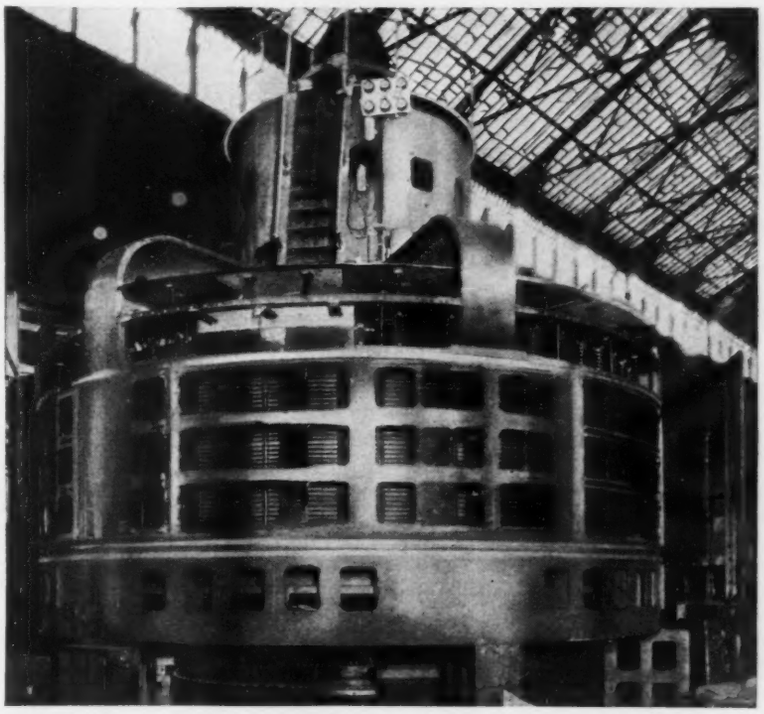
Automatic Transportation Company, Inc., has appointed C. B. Crockett and R. L. Smith as Eastern general sales agents for its complete line of electric industrial trucks, tractors and cranes. Centralized sales and engineering headquarters will be maintained in New York City, with district offices at Boston, Hartford, Buffalo, Newark, Philadelphia, Pittsburgh, Washington, Baltimore and Charlotte, N. C.

•

C. P. Myrick, New England manager of the Edison Electric Appliance Corporation, Boston, has been assigned to the sales department of the General Electric Supply Corporation, Chicago, Ill.

▼

GIANT GENERATOR FOR SEATTLE

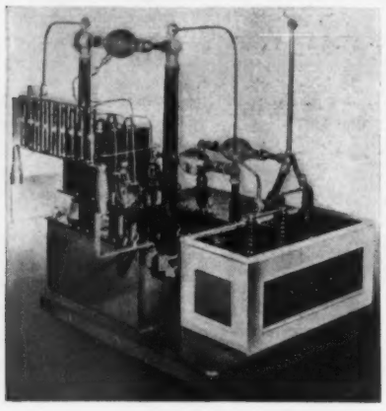


This 66,700-kva. generator, being built in the East Pittsburgh shops of the Westinghouse Electric & Manufacturing Company, will serve the city of Seattle's Diablo 220-kv. development. This and another to be built will be the largest generators to make electricity from water power on this side of the world, it is claimed.

New Equipment Available

X-Ray Machine for 1/1,000-Second Pictures

A three-element X-ray tube and machine which makes possible the taking of an X-ray snapshot in less than 1/1,000th of a second has been announced by the Westinghouse Electric & Manufacturing Company. It enables



physicians to see clearly, for positive diagnosis, the inside of a human body, up to this time blurred or hidden in X-rays by the motion of the patient's muscles.

An interesting feature of this new apparatus is that it can be operated from an ordinary house-lighting circuit and in appearance resembles a large size radio tube. The method of operation is similar to water collecting behind a dam. When the accumulated electricity behind the dam is sufficient the dam is opened, which sends the power suddenly through the tube and the fast picture is produced.

▼

AN INCLOSED FUSE AND RESISTOR ASSEMBLY for potential transformer application, each unit consisting of an S&C RR resistor, 22½ ohms, 1 amp., inclosed in a dustproof housing and an S&C type BR fuse, has been announced by Schweitzer & Conrad, Inc., Chicago. These units are inclosed in a fiber housing, equipped with end bells and insulated terminal connections. The fuse is supported by clips attached to the removable cover so that when the door is pulled from the housing the fuse is removed at the same time. The rating of this assembly is 4,400 volts, 22½ ohms, 1 amp.

•

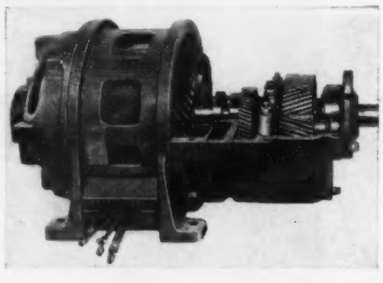
A NEW MOISTURE-PROOF GASKET MATERIAL, which is also highly oil-resistant, and is designated as No. 1000 compound, is recommended especially for applications where the primary purpose of the gasket is to exclude moisture. For such purposes it is said to be superior to cork or other rubber compounds. It is a product of the General Electric Company and is a white, odorless, sulphur-free rubber compound, available both in sheets and molded shapes. It is tough and strong, flexible, requires no sticker and can be used repeatedly, as is stated, in testing work, as well as for permanent joints.

▼

Motors and Speed Reducers Built as Single Unit

Unit drives known as "Gearmotors," consisting of speed reducers combined with motors forming self-contained units only a few inches longer over all than motors alone, have been announced by the Westinghouse Electric & Manufacturing Company. Some advantages afforded by this combination of power and speed-reducing equipment include economy in space requirements, easy and simplified installation, reduced number of drive parts, high efficiency of operation and assured low maintenance requirements.

Each unit includes a Westinghouse type CS general purpose induction motor and a double reduction, nonplanetary type helical gear speed reducer built onto the one-piece motor frame, forming a sturdy and rigid assembly which is supported entirely by the motor feet. An outstanding improvement in motor construction incorporated in these unit drives is the pre-wound primary core which is separable from the stator frame.

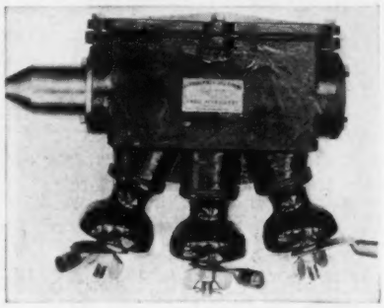


Gearmotors are built in sizes of ½ to 15 horsepower with a wide selection of output ranging from 69 to 1,550 r.p.m. A change in the output of any unit speed can readily be made at a small percentage of its initial cost.

5,000-Volt Inverted Pothead for Outdoor Use

A compact, absolutely tight 5,000-volt pothead with a minimum number of parts is announced by the Anaconda Wire & Cable Company, New York. Among the features claimed are ease in filling with insulating compound, rugged construction throughout, interchangeable nipple for left or right mounting.

The manufacturer points out that this

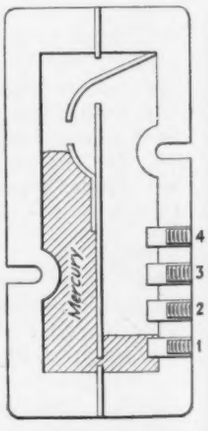


pothead can be mounted on either side of a crossarm and that it is advantageous for pole mounting, as birds cannot build nests and cause outages. The top is removed for installation and compound poured into the pothead rapidly, assuring complete filling without voids.

▼

Time Switch Independent of Temperature Changes

A TIME-DELAY SWITCH unaffected by temperature changes or operating conditions has been developed in the laboratories of the Lincoln Electric Company of Cleveland, Ohio. Its operation may, in a way, be likened to the well-known hour glass, since its principle is the slow movement of mercury from one chamber to another. Wire connections are tapped into one compartment, into which the mercury flows when the switch is in the upright position. As the mercury rises it completes the circuit at the various taps.



By changing one connection to the different taps a variation in time delay is secured in each switch and by varying the size of the small opening at the bottom the switch can be manufactured to give almost any time delay desired. This type of switch can be built for time delay of two to twenty seconds.